

A MCGRAW-HILL PUBLICATION
SEVENTY-FIVE CENTS

Chemical Engineering

JANUARY 13, 1958



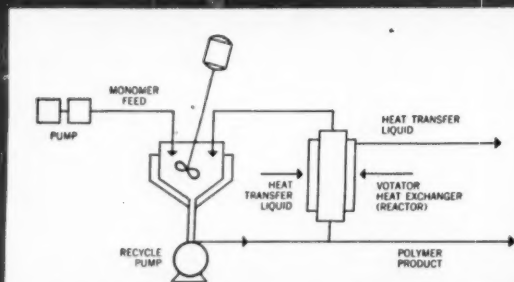
JANUARY						
S	M	T	W	T	F	S
		1	2	3	4	
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

here it is . . .

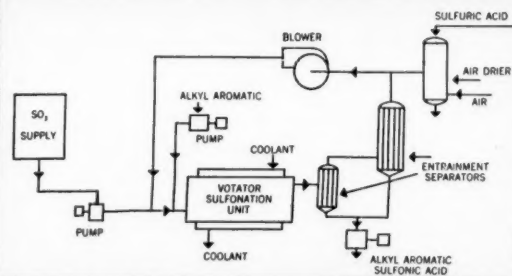
better than ever
and now on an

every-other-monday

publishing schedule



Flow chart for typical continuous reactor with heat transfer liquid.



Flow chart for typical continuous reactor with SO₂ and alkyl aromatic.



HOW *Votator*[®] CONTINUOUS REACTORS

provide rigid heat control and
complete dispersion of reactants

OPERATION. VOTATOR* Continuous Reactors combine multiport injection system with scraped surface heat exchange. This permits handling of those reactions which evolve large quantities of heat, and those end products which are very viscous or result in a reaction product which fouls conventional heat exchange surfaces.

APPLICATIONS include sulfonation, sulfation, nitration, polymerization, saponification, neutralization, condensation, oxidation. Typical flow charts are shown above.

ADVANTAGES. Permits precise control of heat of reaction and improved processing of heat-sensitive materials. Conducts reactions continuously without excessive pressure drops. Immiscible reactants are maintained in finely dispersed state. Variables controlled automatically. Operation is safe, clean. Output is high. Costs are low. Saves floor space.

COMPLETE DETAILS

Bulletin V250 gives complete information — applications, operation, advantages, specifications of VOTATOR Continuous Reactors. Free on request.

* VOTATOR — Trade-Mark Reg. U. S. Pat. Off.



The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

VOTATOR DIVISION: New York • Atlanta • Chicago • San Francisco

JANUARY 13, 1958

JOHN R. CALLAHAM, Editor-in-Chief

Would You Like This Job?

As readers of CE, you're interested in how you'll benefit from our new 26-times-a-year issues (of which this is the first).

Your benefits — which you've asked for in surveys over the past three years—are outlined on p. 137.

As editors, we're naturally steamed up about putting out a fresh, new issue every other Monday; we've been gearing up for the move for over six months.

We've added, for instance, four more editors. But we still have one more to go . . .

Here's what we're looking for in this fifth new editor to help bring you the broadened, timely technical coverage we've mapped out for 1958:

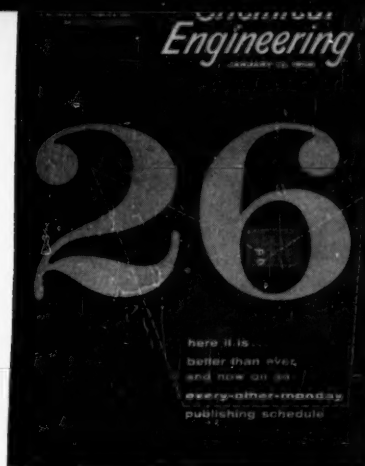
► **Background**—Recent degree in chemical engineering. Up to three years of chemical process industry experience.

► **Abilities**—Able to evaluate technical information on chemical processes, methods, products, equipment. Must be able to write clearly and accurately, to work well with people. Initiative and imagination; creative as well as practical ability.

► **Environment**—New York City, with some out-of-town travel. As Editorial Assistant on CE's staff of 20 engineer-editors. In McGraw-Hill, a growth company, with 35 magazines and some 500 editors.

► **Compensations**—Salary comparable to that in industry. Liberal personnel policies; chance to grow within company. Unusual opportunity to broaden contacts, education and experience. Stimulating work.

If this appeals to you not merely as a job but as a way of life, write at once (with all pertinent facts) to John R. Callaham, Editor, 330 West 42nd Street, New York 36.



FIRST OF TWENTY-SIX ISSUES

1/26

GUIDED TOUR



10 top technological advances to watch during the coming year

Metals and fuels are the highlights of any review of what's new in chemical technology. Products for this jet-atomic age are profiting by the increasingly effective contributions of chemical engineers. But there's more in the "Top Ten" report of trends. It's your guide to present and future developments. (p. 151)



For the first time: six-stage data

Tonnage production in the high-vacuum range casts steam-jet ejectors into an important role. Here are cost and performance data on 4, 5 and—for the first time—6-stage ejectors. (p. 145)



How to think like a computer

Here's a significance rating idea that'll help you direct all your supervisory efforts.

GUIDED TOUR



It doesn't take a complicated computer program. Now you don't have to jump from one emergency to the next. (p. 151)



What about peroxide thermodynamics

All users of hydrogen peroxide will welcome these new data on heat content, published for the first time. Vapor pressure is reported, too, and specific heat can readily be calculated. (p. 155)



Explosions needn't wreck vessels

No longer must rupture disks be picked haphazardly—or even by educated guesswork. Now vents can be adequately designed to protect reaction vessels against damage by internal explosions. (p. 157)



Memo program helps management

Regularly scheduled letters to "Dear Boss" have helped steer management of one company. How could such a program benefit your company operations, personnel relations, employee morale? (p. 181)

CE is edited for the engineer concerned with chemical operations, whatever his function . . . administration, production and plant operations, design and construction, research and development, sales and purchasing. More engineers subscribe to CE than to any other magazine in the field. Print order of this issue:

47,115

Chemical

January 13, 1958

Developments in Chemical Engineering

CHEMENTATOR	73
PROCESSES AND TECHNOLOGY	
Leach Licks Arsenic Bugaboo in Metal Ore . . .	80
Industry Honors Atomic-Metals Pioneers	84
Pack in Low-Cost Capsules	86
CHEMICAL PRODUCTS	
Isotactic Polypropylene Here	92
PROCESS EQUIPMENT	
Cake Indicator Automates Filter	98
CHEMICAL ECONOMICS	
Plant Building Takes a Breather	106
Research \$ Will Be the Spark	110
PROCESS FLOWSHEET	
Zirconium Now Sweeps Into the Big Time	128

Practice of Chemical Engineering

EDITORIAL FOREWORD	
For 1958—26 Times . . . and Better	137
FEATURE REPORT	
The 10 Top Technical Trends of the Year	138
FEATURE ARTICLES	
Selecting Ejectors for High Vacuum	145
C. G. Linck	
Rate Economic Factors by Importance	151
Kenneth Finlayson	
Heat Content & V. P. of H ₂ O ₂	155
D. J. Simkin, C. O. Hurd	
Calculate Adequate Rupture Disk Size	157
J. G. Lowenstein	
Temperature vs. Heat of Vaporization	159
Wallace R. Gambill	

Engineering

Vol. 65, No. 1

PLANT NOTEBOOK

- Mockup for Instrument Panels 164
A. James Waldron
Percent-Time Predicts Process End 166
Herbert Borsvold
Control Flow of Rapid-Settling Slurries 168
C. W. Roos
Easy Silver Plating for Copper Bus Bars 168
Richard Minser
CE Flow File—XIII: Formulas for Slurries 170
Maxey Brooke

CORROSION FORUM

- New Chemical Process Plates Resistant Nickel. . 172

People in Chemical Engineering

YOU AND YOUR JOB

- How "Dear Boss" Letters Spawn Creativity 179
Carl Pacifico
Technical Bookshelf 186
Meet Your Authors 190
Letters: Pro and Con 197
Names in the News 202
Firms in the News 210

Reader Service

- Reader Service Postcards 223
Product Index 225
Guide to Technical Literature 228
Advertisers Index 246
Reprints Available 250

Classified Section

- Professional Services 253
Employment Opportunities 254
Equipment Searchlight 256

Publisher.....Wallace F. Traendly
Editorial Director.....Sidney D. Kirkpatrick
Editor-in-Chief.....John R. Callaham

Engineering Developments

Editor.....Cecil H. Chilton
Associate Editors: Donald R. Cannon, Calvin S. Cronan. Assistant Editors: Frances Arne, John B. Bacon, T. Peter Forbath, Mary A. Gibbons. Editorial Assistant: Roland A. Labine. Economics Consultant: William H. Chartener.

Engineering Practice

Editor.....Theodore R. Olive
Associate Editors: Raymond F. Fremed, Robert B. Norden. Assistant Editors: Thomas H. Arnold, Jr., Steven Danatos, Martin D. Robbins, Editorial Assistant: Charles C. Van Soye.

Presentation & Production

Editor.....Lester B. Pope
Associate Art Directors: Louis H. Dufault, Margaret R. Wenk. Art Assistant: Margi Paul. Editorial Makeup: Carol A. Nelson. Reprints: Elaine G. Garbett.

Regional Editors

Western (San Francisco): Emil J. Mikity. Southwest (Houston): James A. Lee. Washington manager, G. B. Bryant, Jr. Representatives in 73 U. S. cities and 60 foreign countries.

Advertising & Business

Advertising Sales Manager.....J. Elton Tuohig
Business Manager: Anton J. Mangold. Promotion Manager: Hugh T. Sharp. Promotion Assistant: K. Gibbons. Market Service: J. Paschall. Reader Service: N. J. Degenhardt. Advertising Makeup: Grace Barrie. Sales Representatives: See p. 247.

Circulation

Manager.....Paul W. Eib

Chemical Engineering (with Chemical & Metallurgical Engineering) is published biweekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office: 99-129 North Broadway, Albany 1, N. Y. See panel below for directions regarding subscriptions or change of address. **Executive, Editorial, Circulation and Advertising Offices:** 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscription rate in U. S. and Possessions for individuals in the field of the publications \$3 per year (Canada \$4), single copies 75¢. **Position and company connection must be indicated on subscription orders.** Send to address shown in box below.

Second class mail privileges authorized at Albany, N. Y. Printed in U.S.A. Title registered in U.S. Patent Office. ©Copyrighted 1953 by McGraw-Hill Publishing Co., Inc. All rights reserved. Member A.B.P. Member A.B.C.

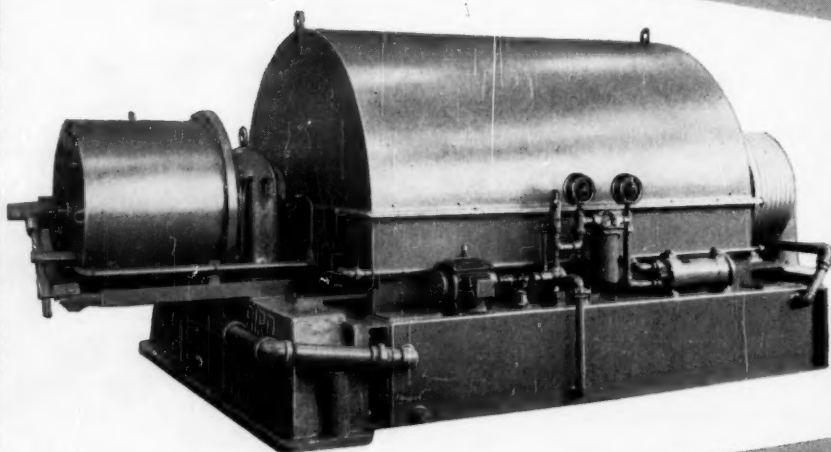
Subscriptions: Send subscription correspondence and change of address to Subscription Manager, Chemical Engineering, 330 West 42nd Street, New York 36, N. Y. Subscribers should send notice promptly for change of address, giving old as well as new address, and including postal zone number, if any. Enclose an address label from a recent issue of the magazine if possible. Please allow one month for change to become effective.

Postmaster: Please send form 3579 to Chemical Engineering, 330 West 42nd St., New York 36, N. Y.

this

BIRD

Covers the Widest Range
of Solid-Liquid Separations



Range of Application — The Bird Continuous Solid Bowl Centrifugal Filter is filtering everything from Aluminum Hydrate to Zinc Sulphide — Fish Meal to Flotation Tails — Potash to Potato Starch — literally hundreds of products.

Range of Solids — from as coarse as half inch to as fine as a fraction of a micron or a mixture of sizes in any proportion.

Range of Feeds — from no more than two or three per cent solids to as high as seventy per cent, and changes in volume or solids content of the feed do not throw the Bird off stride.

Range of Temperature — the Bird is successfully filtering feeds of minus 100° F and feeds of plus 300° F. The solid bowl cannot blind as a result of salting out of hot saturated liquids.

Range of Capacity — the Bird comes in several sizes and designs. Solids throughput may range from 200 lbs. to 60 tons per hour — from a gallon of clarified liquor per minute to 400 gallons or more.

**HOW
ABOUT
YOUR
JOB?**

It's easy to find out, in advance of your equipment investment, whether or not this Bird is *your* best bet, too. The Bird Research and Development Center is equipped to run pilot scale tests giving comparative performance and cost data on the Bird vs. other types of filters. Why not have a look at the facts and figures?

BIRD

MACHINE COMPANY

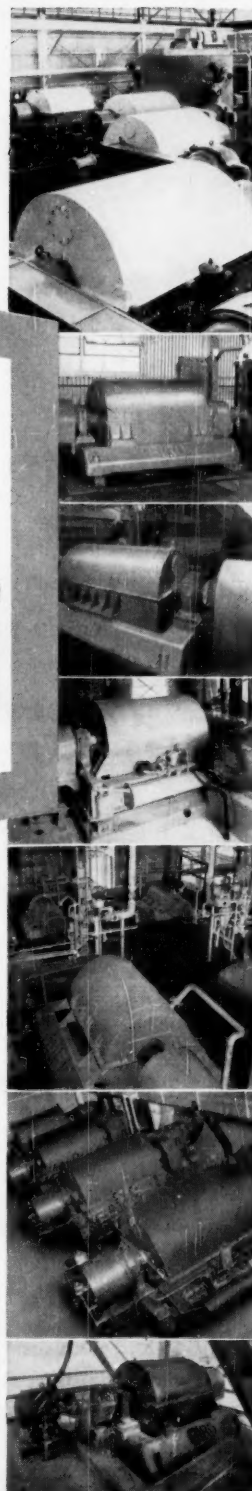
SOUTH WALPOLE, MASSACHUSETTS

Regional Offices:

ATLANTA 18, GEORGIA

EVANSTON, ILLINOIS

WALNUT CREEK, CALIFORNIA



*This issue's
top features
of significance in*

Petrochemicals & Petroleum Refining

JAN. 13, 1958

Also of Basic Interest

Chemotator	73
Processes & Technology ..	80
Process Equipment.....	98
Process Flowsheet	128
Feature Articles	137
Estimate Properties ..	159
Plant Notebook	164
CE Flow File.....	170
Corrosion Forum	172
You & Your Job.....	179
Planned Creativity ..	179
Technical Bookshelf	186
Meet Your Authors.....	190
Letters: Pro & Con.....	197
Names in the News.....	202
Firms in the News.....	210
Reader Service	223
Technical Literature ...	228

New thermoplastic from propylene gas 92

Italy's Montecatini is now marketing "Moplen" —an isotactic polypropylene—which boasts these advantages: resistance to heat, light weight, and low cost.

Petroleum refining bucks the trend 106

While capital spending slows down in most manufacturing industries, one chemical process field—petroleum refining—gets set to spend more in '58 for new facilities.

1957 highlights of interest to refiners 137

Petroleum men are watching these top technological developments of the year: high-energy fuels, fuel cells, fuel solids, pipelines for solids, directed catalysis.

To help you select the proper ejector 145

Today's steam-jet air ejector has a vital role in the production of high vacuum because of the increased use of vacuum operations. Here's some sound advice.

Don't overplay cost elements 151

Not by cost alone should you rate process economic factors. For a more profitable operation, gage their relative importance via this versatile new technique.

In this age of rockets and missiles 155

Hydrogen peroxide is fast emerging as a bright star on the fuel-oxidant horizon. Bone up now on its physical and thermoplastic properties in the pure state.

Size rupture disks safely, this way 157

Guard valuable equipment against rapid pressure rise caused by unforeseen explosions. To do it, you must calculate adequate vent capacity. Here's how.

a finer product through specialization

FLOWLINE **WELDING FITTINGS**

Stainless Steels • Monel • Nickel • Aluminum

... made by specialists
in corrosion-resistant metals



WELDING FITTINGS CORP.
NEW CASTLE, PENNSYLVANIA

World's Largest Manufacturer of Stainless Welding Fittings

You are sure of quality in a camera—just as a welding fitting—when it is made by specialists, because of the techniques of manufacture, so you gain the same "sure" value.

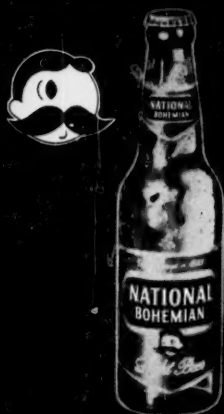
We are the premier manufacturer of stainless steel welding fittings—our entire operation is devoted to the manufacturing of corrosion-resistant welding fittings.

The FLOWLINE fitting is typical of the precision products in our fittings, elbows, tees and pipe. It is cold formed—annealed—oil forged or wrought carbon, and centrifugally casted, and reinforced metal—stronger than the pipe with which it is used.

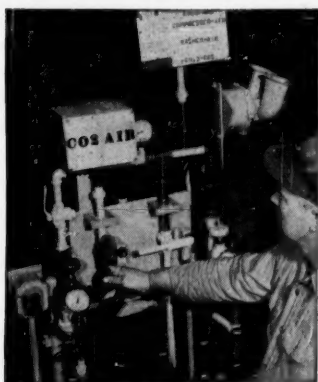
FLOWLINE fittings, elbows, tees, reducers, elbows, and pipe are available from stock through leading distributors. Made in sizes 1/2" through 60" — Schedule 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500, 520, 540, 560, 580, 600, 620, 640, 660, 680, 700, 720, 740, 760, 780, 800, 820, 840, 860, 880, 900, 920, 940, 960, 980, 1000, 1020, 1040, 1060, 1080, 1100, 1120, 1140, 1160, 1180, 1200, 1220, 1240, 1260, 1280, 1300, 1320, 1340, 1360, 1380, 1400, 1420, 1440, 1460, 1480, 1500, 1520, 1540, 1560, 1580, 1600, 1620, 1640, 1660, 1680, 1700, 1720, 1740, 1760, 1780, 1800, 1820, 1840, 1860, 1880, 1900, 1920, 1940, 1960, 1980, 2000, 2020, 2040, 2060, 2080, 2100, 2120, 2140, 2160, 2180, 2200, 2220, 2240, 2260, 2280, 2300, 2320, 2340, 2360, 2380, 2400, 2420, 2440, 2460, 2480, 2500, 2520, 2540, 2560, 2580, 2600, 2620, 2640, 2660, 2680, 2700, 2720, 2740, 2760, 2780, 2800, 2820, 2840, 2860, 2880, 2900, 2920, 2940, 2960, 2980, 3000, 3020, 3040, 3060, 3080, 3100, 3120, 3140, 3160, 3180, 3200, 3220, 3240, 3260, 3280, 3300, 3320, 3340, 3360, 3380, 3400, 3420, 3440, 3460, 3480, 3500, 3520, 3540, 3560, 3580, 3600, 3620, 3640, 3660, 3680, 3700, 3720, 3740, 3760, 3780, 3800, 3820, 3840, 3860, 3880, 3900, 3920, 3940, 3960, 3980, 4000, 4020, 4040, 4060, 4080, 4100, 4120, 4140, 4160, 4180, 4200, 4220, 4240, 4260, 4280, 4300, 4320, 4340, 4360, 4380, 4400, 4420, 4440, 4460, 4480, 4500, 4520, 4540, 4560, 4580, 4600, 4620, 4640, 4660, 4680, 4700, 4720, 4740, 4760, 4780, 4800, 4820, 4840, 4860, 4880, 4900, 4920, 4940, 4960, 4980, 5000, 5020, 5040, 5060, 5080, 5100, 5120, 5140, 5160, 5180, 5200, 5220, 5240, 5260, 5280, 5300, 5320, 5340, 5360, 5380, 5400, 5420, 5440, 5460, 5480, 5500, 5520, 5540, 5560, 5580, 5600, 5620, 5640, 5660, 5680, 5700, 5720, 5740, 5760, 5780, 5800, 5820, 5840, 5860, 5880, 5900, 5920, 5940, 5960, 5980, 6000, 6020, 6040, 6060, 6080, 6100, 6120, 6140, 6160, 6180, 6200, 6220, 6240, 6260, 6280, 6300, 6320, 6340, 6360, 6380, 6400, 6420, 6440, 6460, 6480, 6500, 6520, 6540, 6560, 6580, 6600, 6620, 6640, 6660, 6680, 6700, 6720, 6740, 6760, 6780, 6800, 6820, 6840, 6860, 6880, 6900, 6920, 6940, 6960, 6980, 7000, 7020, 7040, 7060, 7080, 7100, 7120, 7140, 7160, 7180, 7200, 7220, 7240, 7260, 7280, 7300, 7320, 7340, 7360, 7380, 7400, 7420, 7440, 7460, 7480, 7500, 7520, 7540, 7560, 7580, 7600, 7620, 7640, 7660, 7680, 7700, 7720, 7740, 7760, 7780, 7800, 7820, 7840, 7860, 7880, 7900, 7920, 7940, 7960, 7980, 8000, 8020, 8040, 8060, 8080, 8100, 8120, 8140, 8160, 8180, 8200, 8220, 8240, 8260, 8280, 8300, 8320, 8340, 8360, 8380, 8400, 8420, 8440, 8460, 8480, 8500, 8520, 8540, 8560, 8580, 8600, 8620, 8640, 8660, 8680, 8700, 8720, 8740, 8760, 8780, 8800, 8820, 8840, 8860, 8880, 8900, 8920, 8940, 8960, 8980, 9000, 9020, 9040, 9060, 9080, 9100, 9120, 9140, 9160, 9180, 9200, 9220, 9240, 9260, 9280, 9300, 9320, 9340, 9360, 9380, 9400, 9420, 9440, 9460, 9480, 9500, 9520, 9540, 9560, 9580, 9600, 9620, 9640, 9660, 9680, 9700, 9720, 9740, 9760, 9780, 9800, 9820, 9840, 9860, 9880, 9900, 9920, 9940, 9960, 9980, 10000.

cost
no more
than
ordinary
fittings

Partners in Purity



JOY OIL-FREE COMPRESSORS HELP GUARD QUALITY OF NATIONAL BOHEMIAN BEER



Oil-free compressed air is used for other operations in the "National-Bob" plant.

The National Brewing Company, Baltimore, Md., uses oil-free compressed air to regulate an important phase of their processing. Temperature control during pasteurizing is a critical point in the brewing of fine beer. Recording instruments control the steam inlet on preheat and precool tanks. The compressed air that operates these instruments must be free of oil and water or they plug up and record incorrectly.

National brewing hasn't had a bit of trouble with this operation since they installed their first Joy Oil-Free Compressor. These compressors use carbon piston rings that require no lubrication. No oil in the cylinder—no oil in the compressed air.

Is National Brewing happy? They placed a second Joy unit in operation a year later. Find out more about Joy oil-free compressors... write Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company, (Canada) Limited, Galt, Ontario.

JOY ... EQUIPMENT FOR INDUSTRIAL PLANTS ... FOR ALL INDUSTRY



NEED OIL-FREE AIR...
WRITE FOR FREE
BULLETIN 167-11

WBW 1 6584 167



INDUSTRIAL
COMPRESSORS



CONVEYORS

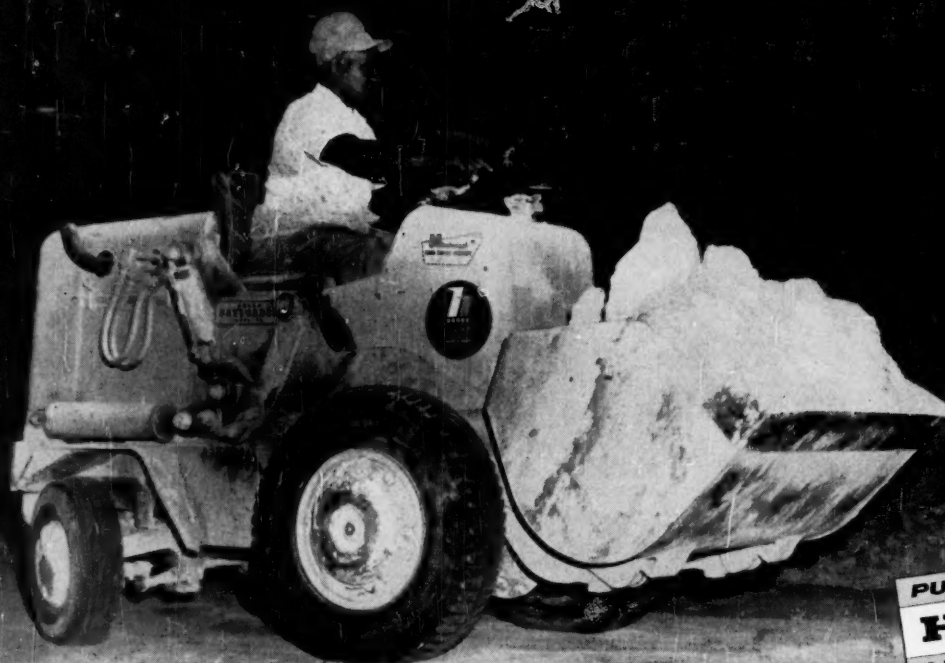


ELECTRICAL
CONNECTORS

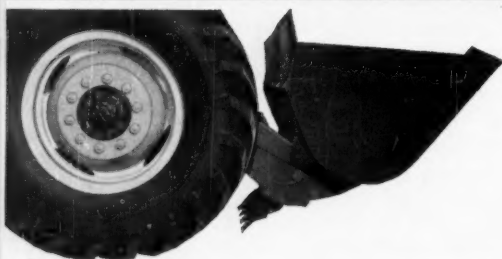


FANS AND
BLOWERS

"...more production...
less operator fatigue...
lower maintenance"



**PURCHASE AND
HOUGH
LEASE PLANS**



RIP UP PACKED FERTILIZER

Scarifier teeth attachments are now available for HA and HAH "PAYLOADER" models — quickly loosen packed fertilizer from runways and floors by reverse "PAYLOADER" travel. Hinged-mounted on the boom — easily removed when not needed.

THE FRANK G. HOUGH CO.
754 Sunnyside Ave., Libertyville, Ill.

Send PAYLOADER information on:

- ☐ HA (2,000 lb. carry) and HAH (3,000 lb. carry)
- ☐ Scarifiers for HA and HAH
- ☐ Larger models (up to 9,000 lb. carry cap.)

Name.....

Title.....

Company.....

Street.....

City..... State.....

3-A-1

Meridian Fertilizer Factory, Hattiesburg, Miss. has 5 model HA and 3 larger HAH "PAYLOADER" tractor-shovels. Speaking of the new style model HA the plant superintendent, William H. Field says, "Roll-back, breakout bucket action and torque converter drive is an ideal combination. Production increased 30% along with lower maintenance and less tire wear and less operator fatigue. We have been using Hough equipment 11 years."

Plant after plant like Meridian testify that they get more and better performance from "PAYLOADER" tractor-shovels. They tell us that roll-back bucket action, hydraulic-load-shock-absorber, breakout digging action and the many other "PAYLOADER" features all add up to increased production, lower maintenance and greater safety.

If you have an older model HA or model HAH "PAYLOADER" or any other tractor-shovel in their size ranges, it will pay you to see how much more these new style units can produce. Your Hough Distributor would like to show you. Contact him today, and ask about Hough Purchase and Lease Plans too.



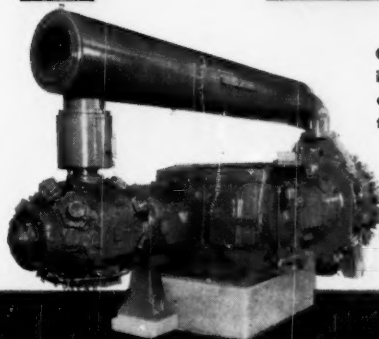
PAYLOADER®

MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

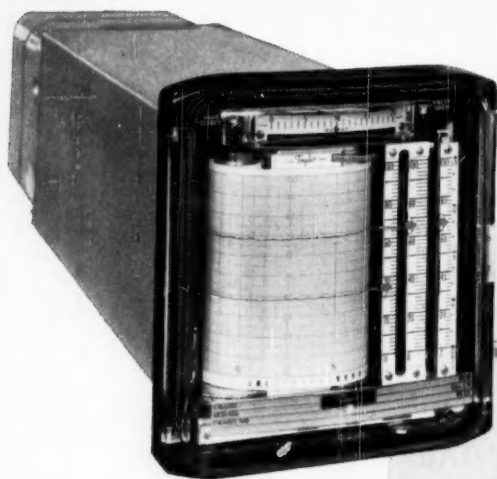


AIR FOR INDUSTRY

● Be sure to check on the new advantages in low-cost compressor service, packaged simplicity, extreme durability, easy installation and low maintenance, offered by one of America's oldest compressor builders. Write for descriptive bulletins . . . or phone Mount Vernon, EX 3-0121.

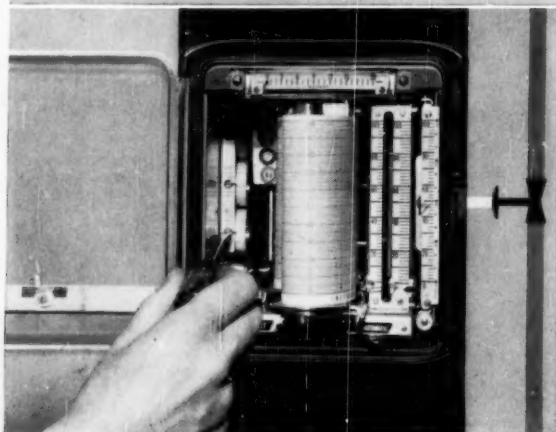
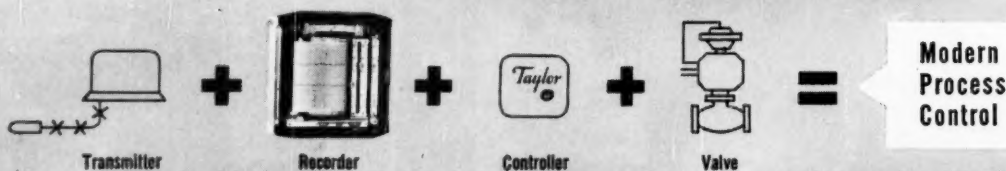
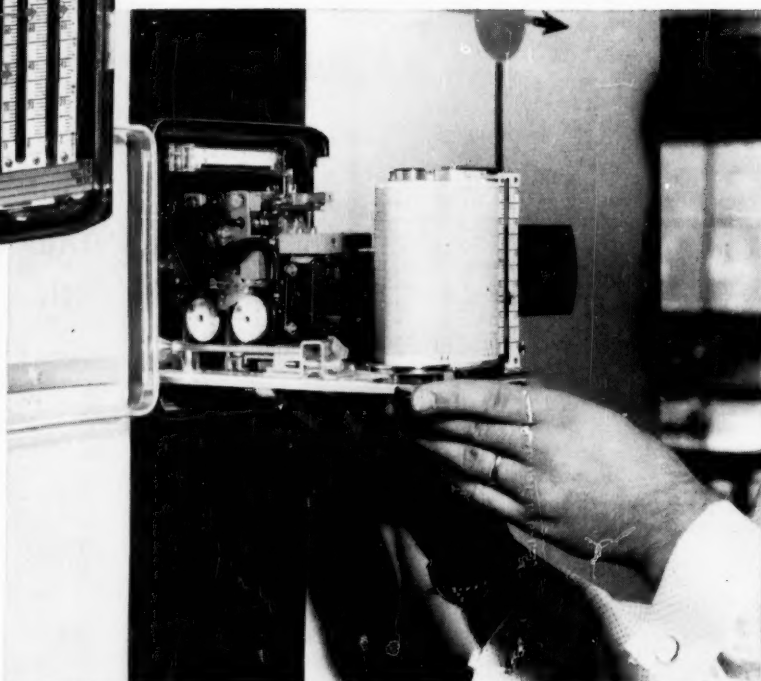


Cooper-Bessemer packaged industrial air compressors are available in four basic types from 200 to 6000 hp.

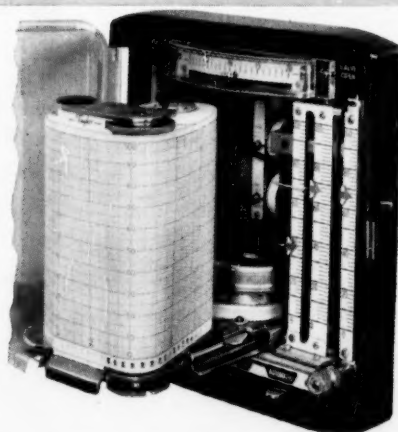


Never before

Unique new Taylor **TRANSCOPE Recorder** plugs into panel-mounted manifold—an integral part of the sleeve. Model shown is the 2 pen recorder with continuous set point, automatic-to-manual switch and output pressure indicator. "Servomatic" power pens provide 150 times more power than conventional bellows-actuated type, assuring life long accuracy.



Controller settings are made from the front while recording. Gain, reset and PRE-ACT® dials are calibrated in specific units. Eliminates blind adjustments—settings and results are seen in one spot . . . the front of the panel.



Most dependable chart drive. Chart is held in positive position and driven by rectangular pins. Timing control is absolute, because chart drum is driven by a Gilmer, chain-like belt. No jerking, because new Rulon bearings cut power needs in half. 4", 30-day chart gives 3 hour visible record.

...so Many Features in so Little Panel Space!

Taylor's new 90J Series TRANSCOPE* Recorder is a giant step forward in the development of convenience and compactness for modern instrument panels. No other recorder, regardless of size, puts so many features in so little panel space.

- **Front-of-Panel Control Settings** let you make adjustments easier, quicker, and better... from the front of the panel... while recording! You can clearly see what you are doing, and the results, because the record is continuous.

- **Stays on Automatic Control** while the recorder is removed for inspection. The unique Set Point Transmitter remains plugged in the case, providing continuous fully automatic control.

- **Complete Indicating Control Station** while recorder is removed. You see the variable. There's no need to shut down the process for instrument service or adjustments. Horizontal gage at top of recorder will show either process variable or air output to valve, as desired.

- **More Accurate Records.** Responsiveness to transmitter output is 0.1%; and because of the very small pneumatic displacement of the input capsule, the response is

practically instantaneous. You see more minute process changes, so you can make optimum control setting. SERVOMATIC power pens assure accurate pen position.

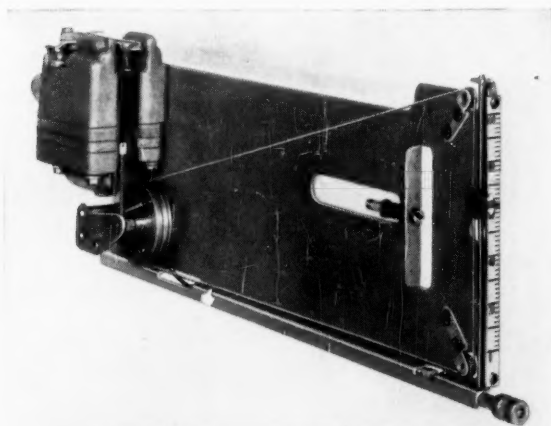
- **Interchangeable Components** — all major assemblies, components and unit parts are completely interchangeable. Both the TRANSCOPE Recorder and Controller may be changed in the field from simplest to most complete form.

- **Receives Three Variables** to be recorded or indicated; has a set point transmitter, an automatic-to-manual switching lever, a cascade or process-output indicator, and many other features... all in a compact case.

- **Complete Cascade System** — a complete master-slave combination, in a smaller case than ever before. Perfect for direct control of composition, as well as the usual cascade control applications.

For further information about this revolutionary new recorder, see your Taylor Field Engineer, or write for **Form No. 98282**. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ontario.

*Trade-Mark



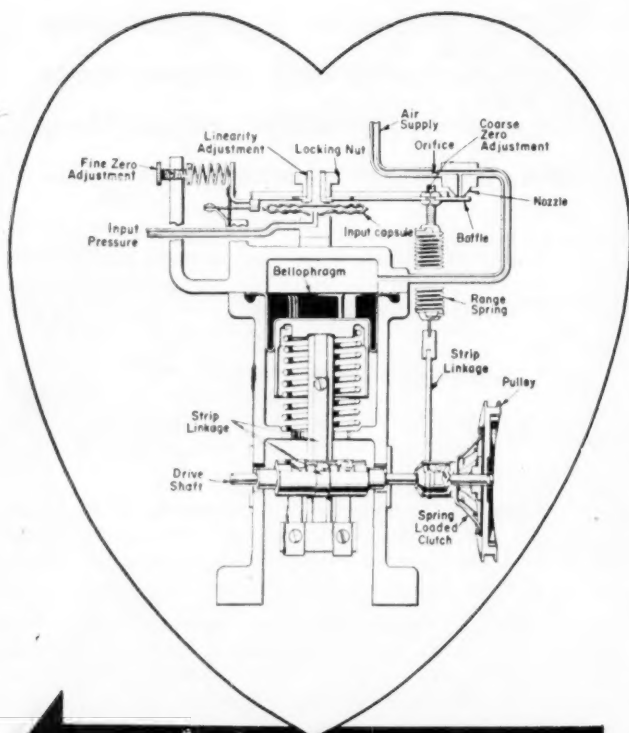
Exclusive "Set Point Transmitter" allows continuous automatic control during recorder removal. The plug-in transmitter assembly may be removed and the control valve sealed in operating position. No need for process down time for instrument inspection or servicing.

SEE NEXT 2 PAGES

Taylor Instruments
— MEAN —
ACCURACY FIRST

VISION • INGENUITY • DEPENDABILITY

New standards of ... in recording

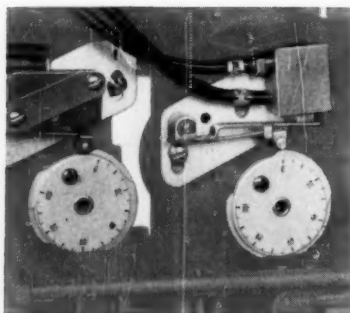


The Revolutionary NEW Taylor TRANSCOPE* Recorder

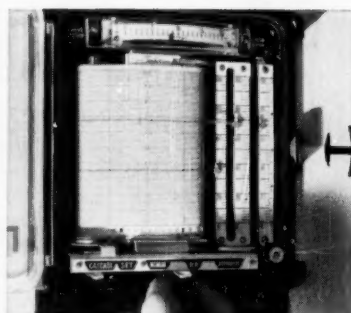
"SERVOMATIC MOTOR" assures lifetime accuracy of pen position. Transmitter signal is received and amplified by individual force balance servo-mechanisms. Efficient spring feedback and powerful longstroke pneumatic motor give *150 times greater power than normally available for pen positioning*. This means greater accuracy; less service needed. If you like servo-operated devices . . . power steering, power brakes . . . you'll want SERVOMATIC powered pens.

0.1% THRESHOLD SENSITIVITY—A NEW STANDARD OF ACCURACY. Responsiveness to transmitter output is 0.1%; and because of the very small pneumatic displacement of the input capsule, the response is practically instantaneous. You see more minute process changes, enabling you to make optimum control settings to increase yield of specification product. All servos are identical and interchangeable. Servo-pen connection is by means of cable . . . no long, jointed, flimsy links or levers. Allows perfect linear conversion from rotary motion . . . repeatability is truly amazing.

SEE PRECEDING 2 PAGES



OPTIONAL ALARMS. Each SERVOMATIC motor can operate either an electric or a pneumatic alarm. Each alarm can be adjusted for one high and one low, or two high, or two low operating points. Microswitch on left, air valve on right.



AUTOMATIC-TO-MANUAL SWITCHOVER. Automatic-to-seal-to-manual switching lever gives smooth, bumpless transfer—no air leakage while switching. Incorporates matching of set point to output. Similar lever for Cascade-Set switch.

Write for Form No. 98282



NO MESSY PEN FILLING. 3-months ink supply comes factory sealed in disposable clear plastic cartridge—instantly replaceable. Rides on indicator arm. Powerful SERVOMATIC drive eliminates effects of friction and changing ink supply.

Accuracy ...in controlling!



Taylor TRANSCOPE* Controller is last word in Pneumatic Process Control!

The TRANSCOPE Controller recently announced, and the TRANSCOPE Recorder, described on the preceding three pages, are companion instruments. Together they give you new standards of process control performance...unprecedented accuracy and adaptability.

Check these features:

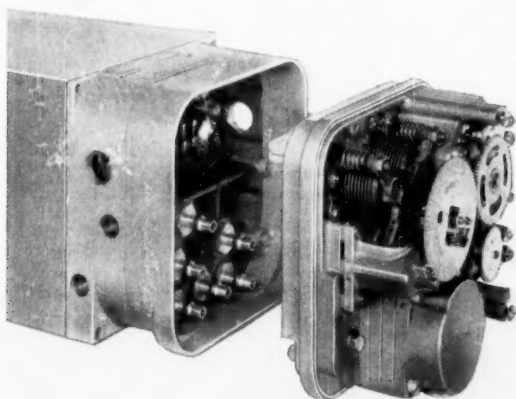
Outstanding performance because it's especially suited for short spans of measurement...ideal for time constants of modern processing. It's exceptionally fast and responsive to adjustments, vital on start-ups. Adjustments stay put because precision manufacture of gain, reset and PRE-ACT* units permits predetermined mathematical settings.

Exceptional adaptability to changes in process requirements because components are completely interchangeable...in the field...in minutes. Instrument action is reversed by merely rotating a dial. It plugs into the TRANSCOPE Recorder or a locally mounted manifold.

Simple maintenance because it's easy to understand, easy to get at. Rugged bellows assembly, keyed in place, moves the dynamically balanced force plate; friction-free bending member never needs maintenance. Assemblies are of rugged, die-cast aluminum. Stainless steel nozzle and baffle are easily accessible; reaction members of hardened stainless steel. Ball bearing construction gives easy screw-driver alignment. Integral cut-off relay is a built-in feature.

Ask your Taylor Field Engineer, or write for Bulletin 98278. Taylor Instrument Companies, Rochester, N.Y., and Toronto, Ontario.

*Trade-Mark

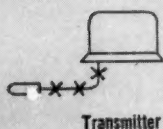


Taylor Instruments

— MEAN —

ACCURACY FIRST

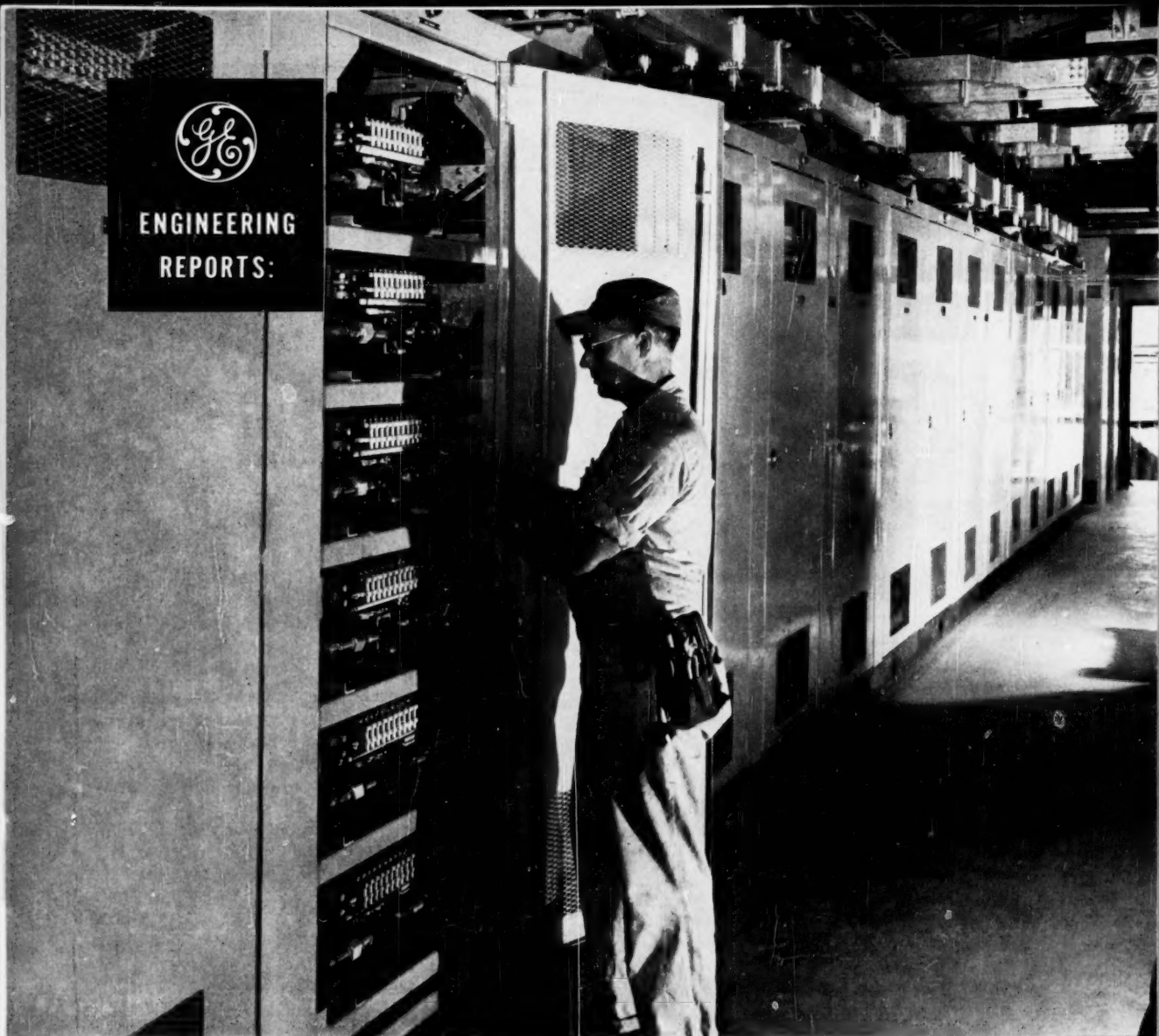
VISION • INGENUITY • DEPENDABILITY



Modern
Process
Control



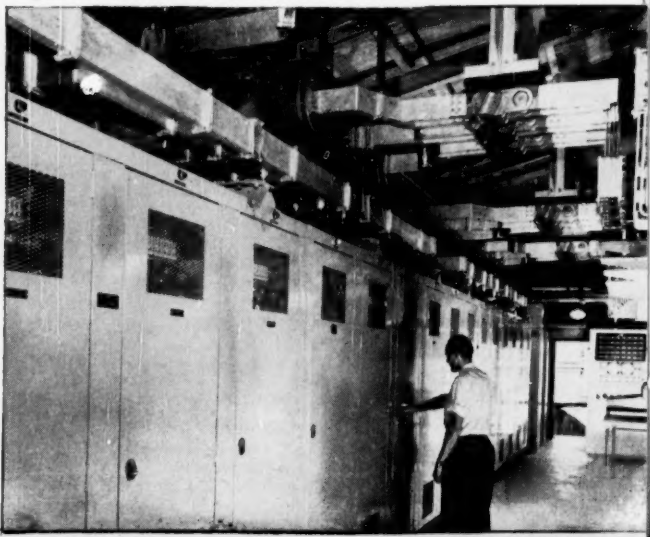
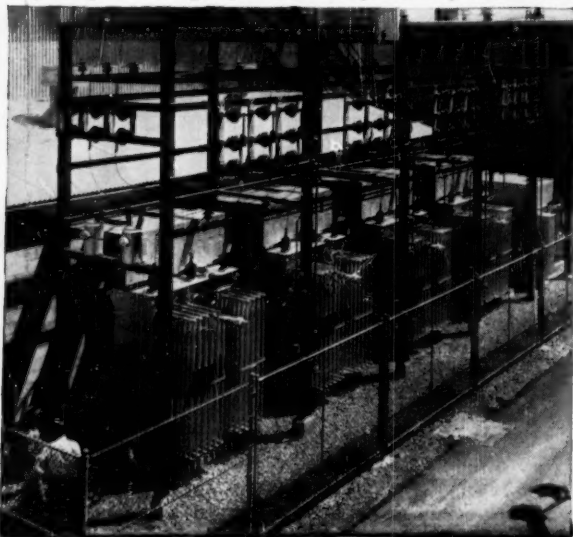
ENGINEERING REPORTS:



COMPACT LINEUP of germanium rectifiers total 30,000 amps, at 150 volts. Each contains three rectifier and one coolant system compartments. Regulating autotransformer and induction regulator (outside) reduce incoming power at 22 kv to 13.8 kv.

OVERHEAD METAL enclosed busway connects four rectifier transformers with rectifier compartments inside. Busway is factory-designed for high system efficiency and easy installation.

OUTPUT CURRENT is measured by d-c current transformers. Signals from d-c c-t's are fed into regulating equipment to provide automatic control of load current.



AT DOW CHEMICAL'S PITTSBURG, CALIFORNIA, PLANT . . .

NEW General Electric d-c power system improves process efficiency

**G-E germanium rectifier system increases power available
for chlorine-caustic electrolytic cell operation.**

The Dow Chemical Company's Western Division Plant at Pittsburg, California, has improved efficiency and power available for its chlorine-caustic electrolytic cell operation. Utilization of new General Electric germanium rectifying equipment integrally designed into a co-ordinated electrical system allows automatic control of the operation's electric supply and has resulted in reduced operating costs.

Prior to the new installation of equipment, the electrolytic cell lines of similar ratings—30,000 amps at 150 volts d-c—were powered by motor-generators. Now the new system is able to provide high d-c current with an efficiency of over 95 per cent even at a low voltage. Germanium's low power loss also means that equipment necessary for cooling is kept to a minimum. Being a static device, the germanium rectifier system at the Dow plant offers the additional advantage of low maintenance. This equipment is ideally suited to such ap-

plications due to inherent high efficiency of the germanium rectifier.

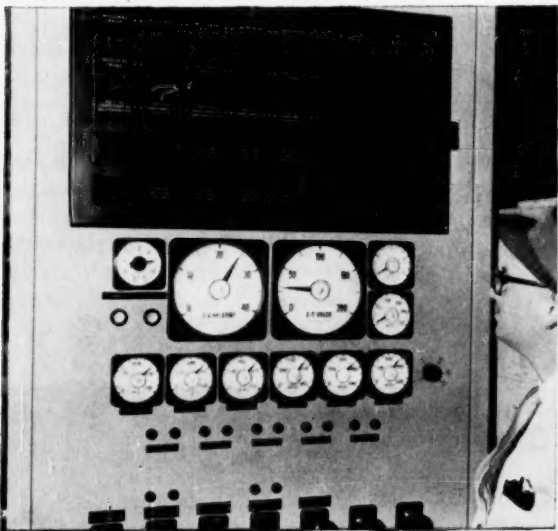
Semiconductor rectifiers of the germanium type used at Dow, or silicon type, provide efficient, highly reliable, and flexible systems for electrochemical applications.

Co-ordination of the equipment into a flexible electrical system—designed to meet this plant's special needs—resulted from close co-operation between Dow Chemical and General Electric engineers. To meet your specific power system needs, General Electric engineering services can help design, equip and install a co-ordinated electrical system from one-line diagram to on-time start-up. Early in your planning (feasibility stage), call your General Electric Apparatus Sales Office. Meanwhile, write for bulletins GEA-6375A on semiconductor power rectifiers, and GEA-6684 on semiconductor rectifier power conversion systems, to the General Electric Company, Section 662-50, Schenectady 5, N. Y.

Engineered Electrical Systems for the Chemical Industry

GENERAL  ELECTRIC

EYE LEVEL operator's panel for rectifiers provides manual and automatic control, individual and total rectifier load indication, alarm and annunciator functions.

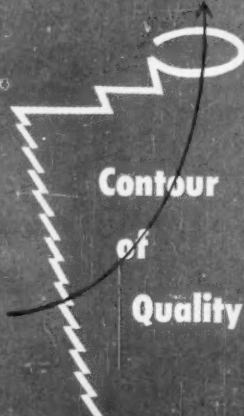


RECTIFIER SYSTEM overcurrent problems are eliminated by providing protective relays in each rectifier direct-current output circuit.



A new slant on industrial Cooling Towers

New Marley Class



Contour
of
Quality

NEW IN PROFILE — NEW IN PERFORMANCE. These characteristic advances announce a forward trend in cooling towers and introduce the new Marley Class 600 Double-Flow and Single-Flow models. They embody design improvements that are seven-league strides in water cooling practice and achievement. • • • The new profile is completely functional. It is the basis of many fundamental changes that mean increased cooling capacity in every frame size with greater power economy and no additional basin cost. Class 600 Cross-Flows have more filling and the ability to keep more water in the fill area; to reduce direct, unbroken water fall. The fill is of uniform width at all elevations, exposing the water to equalized air flow at all points of the cooling chamber. • • • From the new wide louvered walls to the fan, air flow is cleared of obstructing elements. Pressure control and air

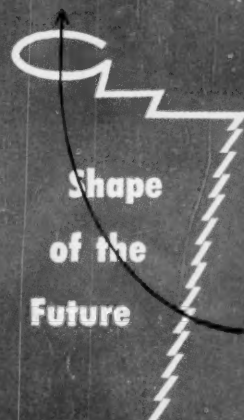


600 Double-Flow

discharge are more proficient. This lowered draft loss efficiently balances increased water capacity in Class 600 Cross Flows. • • • The angled louver walls make possible simple controls that facilitate winter operation in areas where icing is a problem. • • • In Class 600 Cross-Flows extended durability—increased resistance to corrosion—keeps pace with stepped-up cooling ability. They are the first standard models completely asbestos cement board encased, and they introduce inert materials for use throughout the structure. • • • These towers establish a quality standard new to water cooling equipment and of importance to you as an investor. You can get all detailed information from the nearest Marley engineer in 56 major cities or by writing direct.

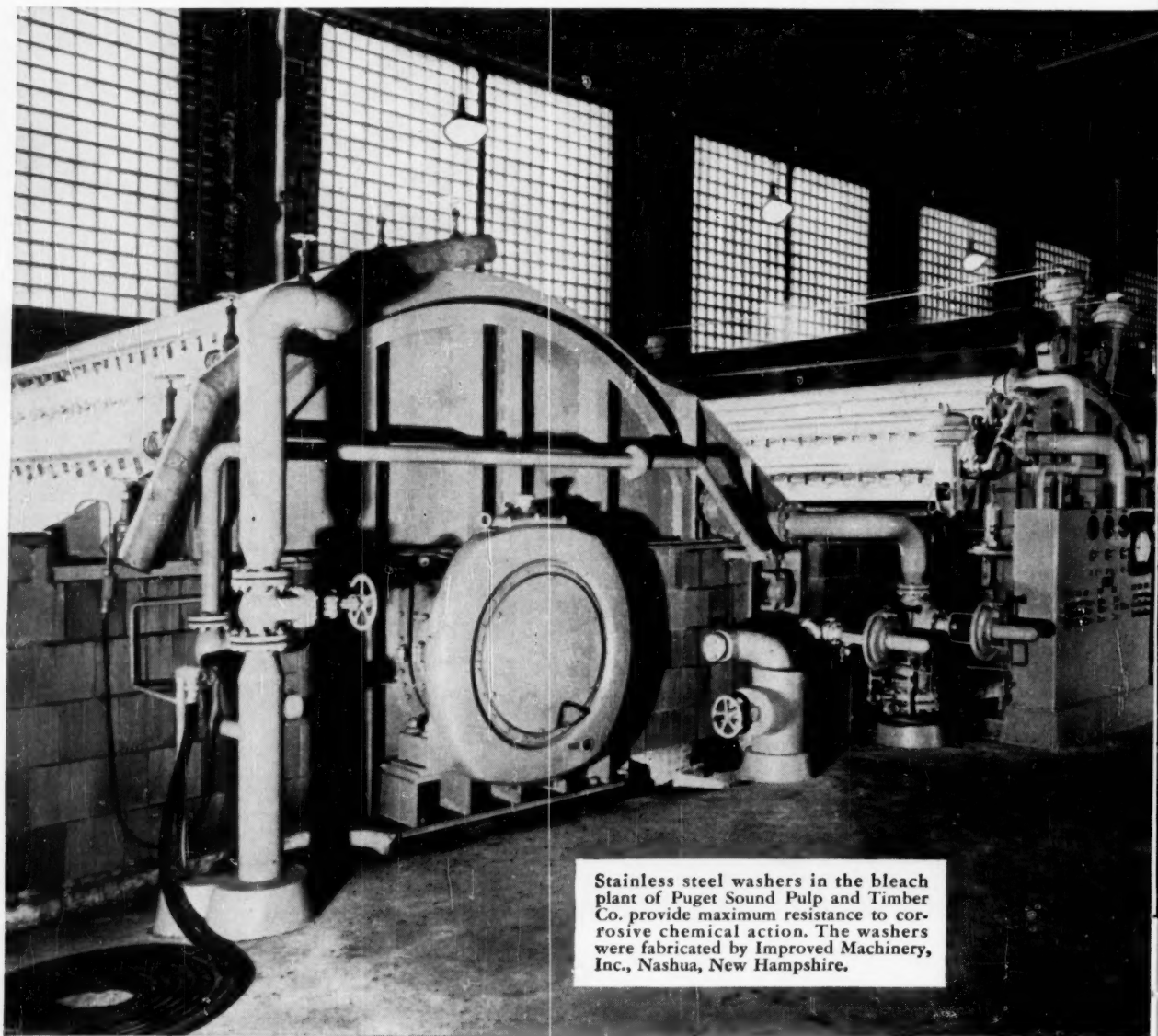
The Marley Company

Kansas City, Missouri



Shape
of the
Future

Pulp Washing in



Stainless steel washers in the bleach plant of Puget Sound Pulp and Timber Co. provide maximum resistance to corrosive chemical action. The washers were fabricated by Improved Machinery, Inc., Nashua, New Hampshire.

REPUBLIC



World's Widest Range of Standard Steels

STAINLESS STEEL

**safeguards quality, keeps costs in line,
assures continuous production**

At Puget Sound Pulp and Timber Company, Bellingham, Washington, a combination of long experience, fine raw materials, and modern equipment results in a superior pulp product.

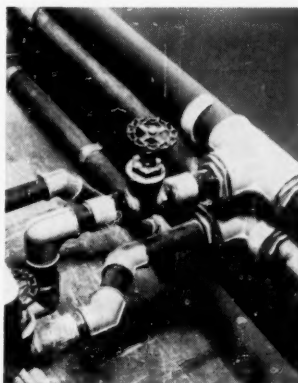
The chlorination and hypochlorite washers, shown at left, are installed at Puget Sound's bleach plant. They are indicative of the Company's widespread use of modern stainless steel equipment. No other construction material offers a combination of qualities and physical properties so essential to the mechanical and chemical stages of pulp making and processing.

Stainless steel safeguards pulp quality. Stainless steel is solid. It has no applied surface to crack, chip, flake or peel. There is no danger of metallic contamination. Stainless is inert to most chemicals and chemical compounds. It does not add unwanted elements to spoil product quality. It never takes anything away.

Stainless steel keeps costs in line. Stainless is easy to clean and keep clean. Usually, a simple flushing with water or diluted acid solution brings stainless steel back to sparkling cleanliness. Stainless steel offers the highest resistance to corrosion of any commercial metal currently being used for pulp and paper making. As a result, it provides substantial savings in maintenance and replacement costs. Stainless equipment is an investment in long-range savings.

Stainless steel assures continuous production. In addition to its outstanding corrosion-resistance, stainless steel offers "bonus benefits" in the form of high strength, heat-resistance, abrasion-resistance. The exceptionally high strength of stainless takes stress and vibration in stride. Stainless equipment resists scaling at high temperatures. Possesses high creep-strength. Shrugs off abrasion. Your original investment in stainless steel equipment will be returned many times over in the form of uninterrupted and profitable production.

Selecting the proper type of stainless is extremely important. Republic—world's largest producer of alloy and stainless steels—will help you make that selection. Our metallurgists are constantly working with processors and equipment builders in applying the many available Republic ENDURO Stainless Steel analyses to best advantage. May we help you? There's no obligation. Just mail the coupon.



KEEP PIPE COSTS IN LINE with tough, lightweight Republic Plastic Pipe. Blaw-Knox did in a cooling tower installation. Corrosive liquids were running up replacement costs. Piping lasted little more than a year. Other materials were tried, but initial costs proved too high. Then Blaw-Knox switched to Republic SRK—the corrosion-resistant plastic pipe that practically eliminates replacement costs. A similar job, installed three years ago, shows absolutely no signs of damage or wear. A substantial savings in material, installation and replacement cost was realized. Republic SRK is easily joined by simple solvent-welded sleeve-type fittings. Send coupon for complete facts.



GUARD AGAINST PRODUCTION SHUT-DOWNS by protecting your electrical wiring systems with Republic ELEC-TRUNITE "Dekoron-Coated" E.M.T.—the electrical raceway that shrugs off corrosion. A tough coating of polyethylene encases lightweight, strong ELEC-TRUNITE® E.M.T. in an end-to-end armor that is impervious to excessive moisture and corrosive fumes. It can be cut to length and bent to fit as easily as standard E.M.T. conduit. Also available on hot galvanized rigid steel conduit. Joints are protected by polyethylene or vinyl-backed electrical tapes. Contact your local electrical distributor. Or mail us the coupon for more details.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION

DEPT. C-3993

3116 EAST 45TH STREET • CLEVELAND 27, OHIO

☐ Please have a Stainless Steel Metallurgist call.

Send more information on:

☐ ENDURO® Stainless Steel

☐ SRK Plastic Pipe

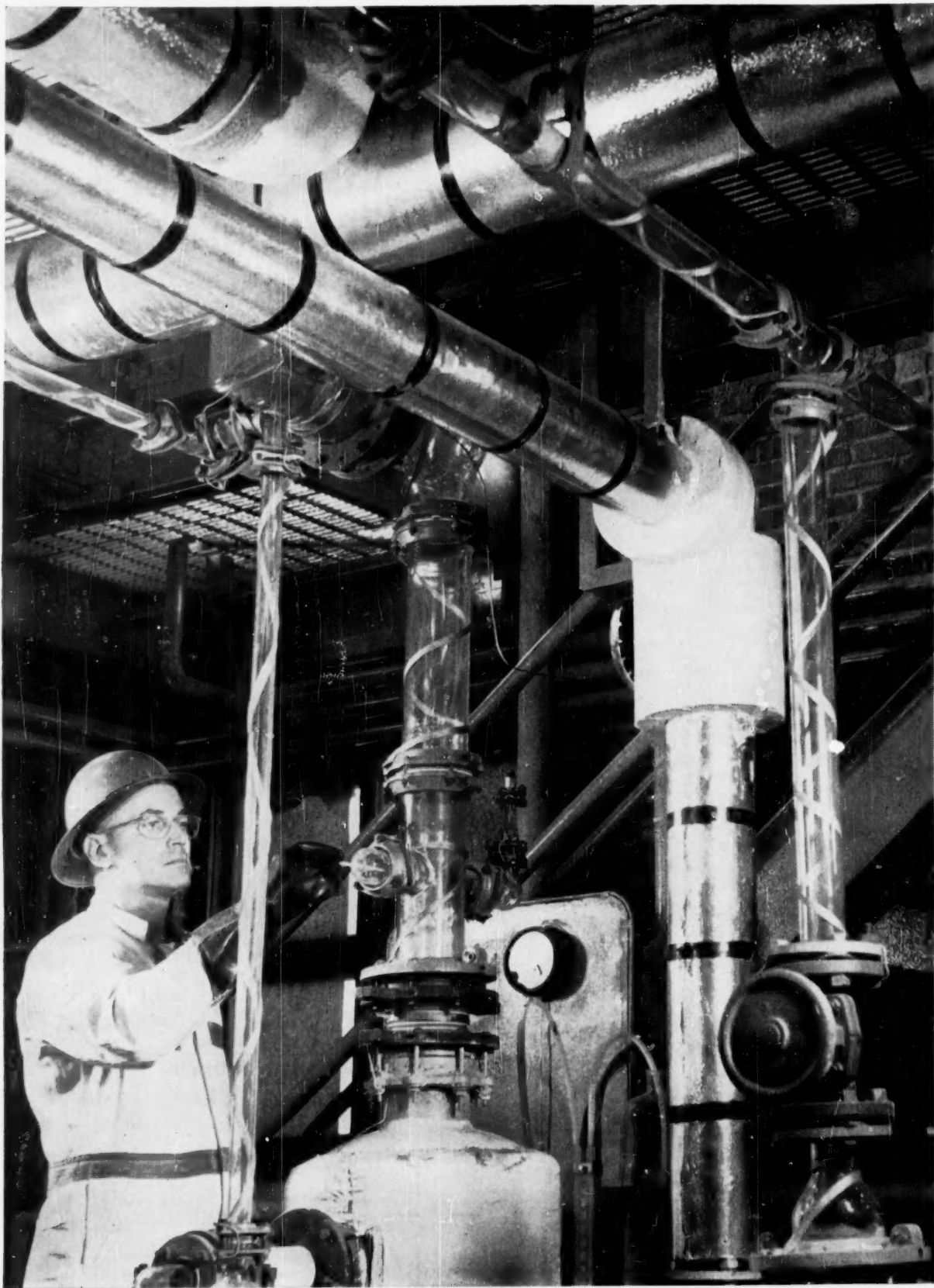
☐ ELEC-TRUNITE "Dekoron-Coated" E.M.T.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____



Between this man and a highly volatile chemical lie only PYREX® Pipe and confidence

At this ether distillation operation in a Baker & Adamson plant precaution is the password; you can see it in the hat, the gloves, the static ground wrappings on the pipe . . . and the pipe itself.

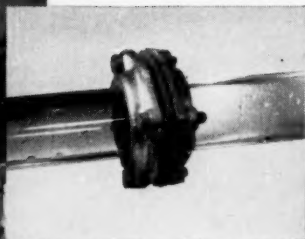
The pipe is strong. You can't take chances with pure ether. "Double-Tough" PYREX Pipe is made to take pressure and heat and a goodly amount of mechanical abuse.

The pipe cannot corrode. Not from ether or from any other chemical but hydrofluoric acid and hot alkalis.

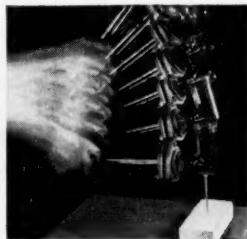
The pipe cannot contaminate. It's completely inert—vital when you're making an A.C.S. Reagent Grade chemical.

And the pipe is transparent. You can see what's going on inside PYREX Pipe. Maintenance men can judge its condition at all times just by looking. Should a blocking occur they can spot it exactly and ascertain its nature *without* opening the pipe.

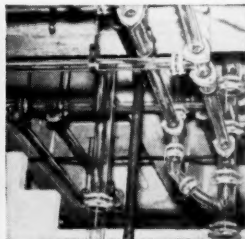
Such features should certainly induce you to learn more about this remarkable pipe by writing for Bulletin PE-3.



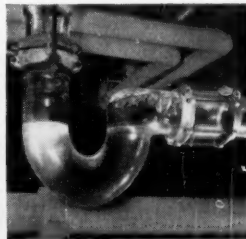
It's easy to install: Any plumber can install this drainline. One contractor proved he could make connections with PYREX drainline 16 times faster than bell and spigot connections. All fittings are standard.



It's hammer-strong: You can actually hammer nails through a block of wood with PYREX drainline. A new heat-strengthening process makes pipes and fittings $2\frac{1}{2}$ to 3 times as strong as ordinary glass.



It's easy to clean. Even the stickiest chemicals find it hard to cling to the glass from which PYREX Pipe is made. Should they stick, a simple acid or steam flushing removes them quickly.



Same glass for drainlines: You can set up complete drainlines with this same PYREX Pipe. All components—from cup sinks to traps to outlets are readily available.

◀ Raw ether runs through these PYREX Pipes at a Baker & Adamson plant without a trace of corrosion or product contamination.



CORNING GLASS WORKS, 11 Crystal Street, Corning, New York

Corning means research in Glass

Westinghouse ***Life-Line A*** motors

helped save \$13,500 in olive pitting operation...

at Bell Packing Corporation
Berkeley, California

Continuously driving brine pumps for olive-pitting operation, Westinghouse motors have helped cut production cost, improve product quality

"Westinghouse Life-Line 'A'® motors make possible the profitable functioning of the new pitting room in our olive canning plant," states Mr. William Carlson, Plant Superintendent at Bell Packing Corporation, Berkeley, California.

Mechanizing this operation has increased production 15% and released a good share of the normally required manpower for use elsewhere in the plant. In three years, Bell Packing reports a saving of \$13,500. In designing the area, Bell Packing Corporation considered the choice of motors for the brine pumps the most serious problem. Westinghouse 1 hp, Life-Line "A" motors were chosen on their record of long-term, trouble-free life under the toughest conditions.

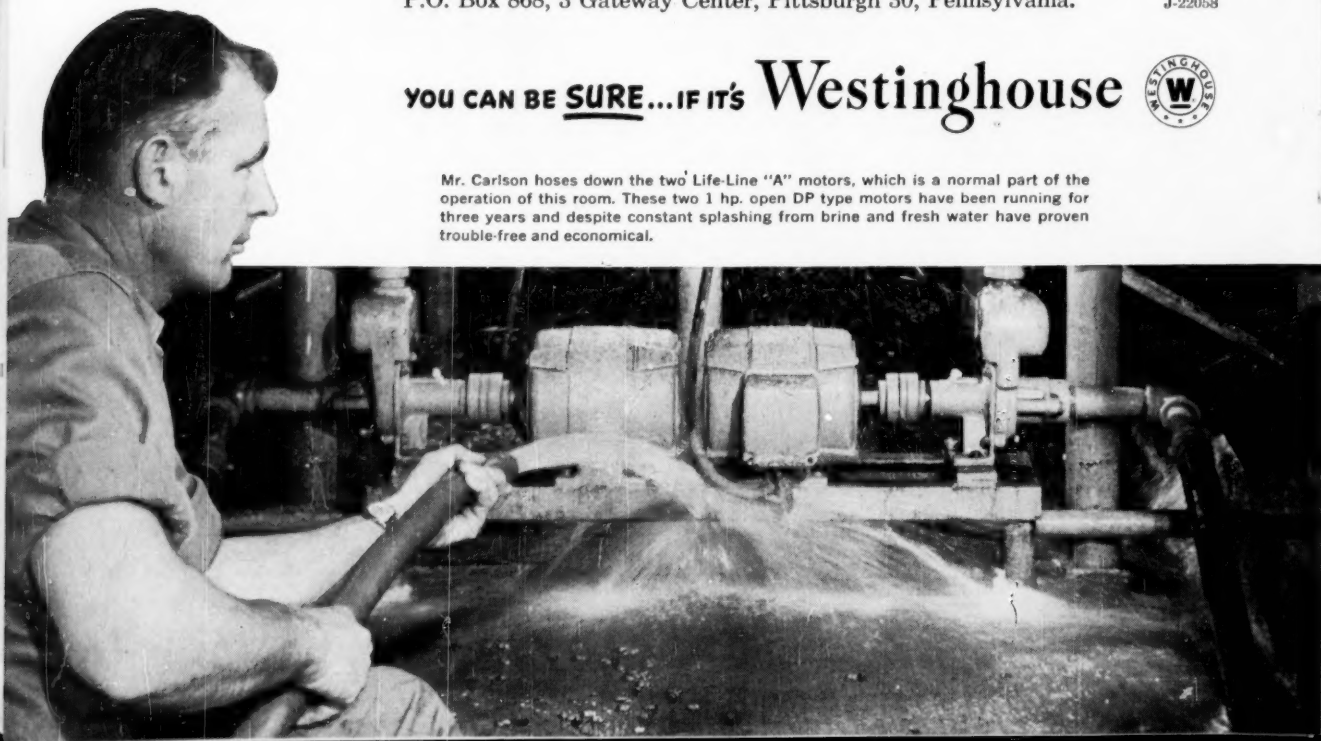
POWER-UP with the motor designed to meet modern industry's needs. For complete information, call your Westinghouse sales engineer, or distributor. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

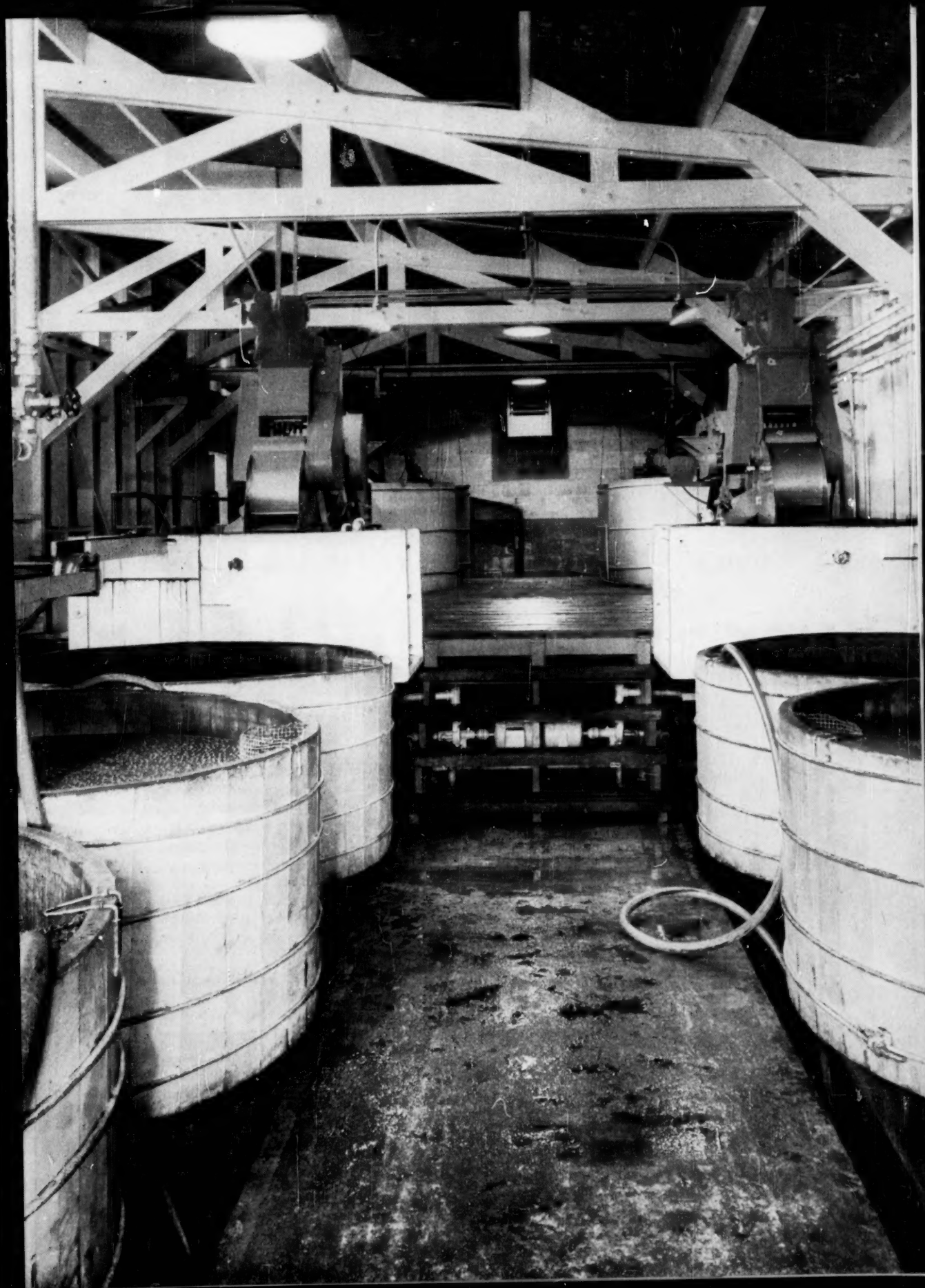
J-22058

YOU CAN BE SURE...IF IT'S **Westinghouse**

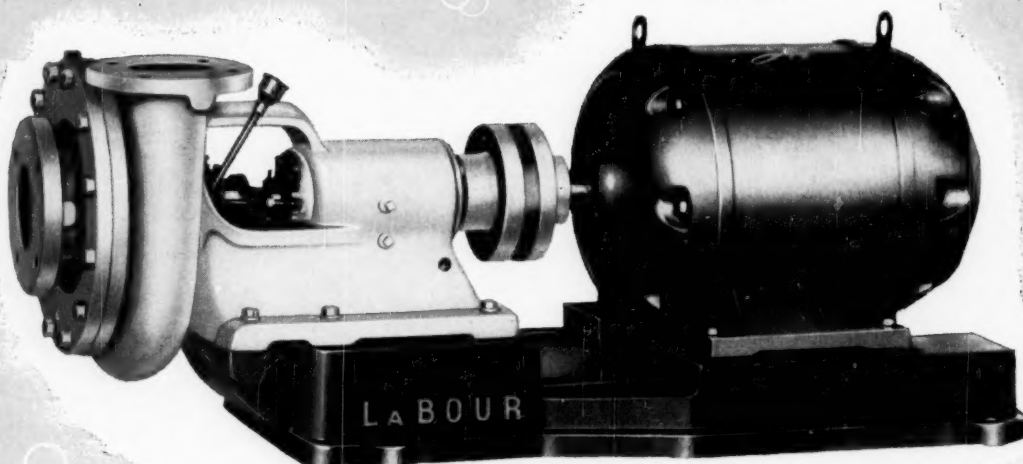


Mr. Carlson hoses down the two Life-Line "A" motors, which is a normal part of the operation of this room. These two 1 hp. open DP type motors have been running for three years and despite constant splashing from brine and fresh water have proven trouble-free and economical.





when BUBBLES



mean TROUBLES

Aerated solutions and volatile liquids are difficult or impossible to handle with ordinary centrifugal pumps, yet in many operations use of positive displacement pumps just brings on troubles of a different kind. The answer is LaBour Type Q, a non-priming centrifugal with extraordinary ability to handle large amounts of air or vapor mixed with the liquid it pumps.

Occasional "gulps" of air or vapor will not bind a LaBour Type Q. In general, Type Q

can rid itself of gases not exceeding 20% of the total volume being pumped. Thus it is suited for many applications which would otherwise require a more costly self-priming unit.

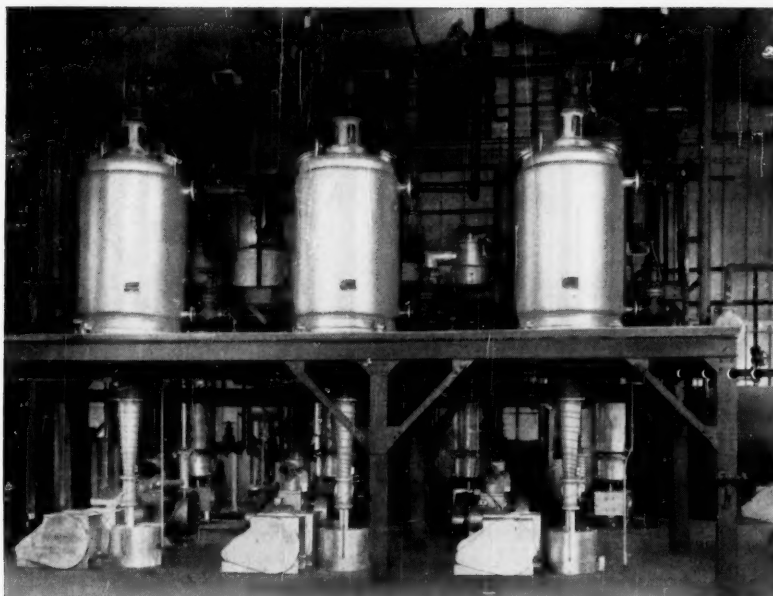
LaBour dependability is of course a feature of this pump, which has only one moving part and no close clearances. If you're having an air or vapor problem, particularly in connection with corrosive liquids, you'd better drop us a line.

ORIGINAL MANUFACTURERS OF THE SELF PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. • ELKHART, INDIANA, U. S. A.





Paraffin at a Fraction of a cent Per Pound!

Three Asco Molecular Still at
Trans Penn Oil Co. Can Produce
More than One Tank Car
Per Day



ASCO ROTA-FILM

The Only Molecular Still
Sold on a
Royalty-Free Basis

are you the 1 in 20* who knows how MOLECULAR DISTILLATION can increase profits?

If you are that one, you know that Molecular Distillation can process organic compounds with molecular weights from 200 to 1250 and silicones and halocarbons to 4000.

This means that a broad range of processes can be carried out with better results and at far less initial cost and far less operating cost than by methods commonly used. Here are a few such processes:

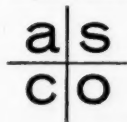
- Vitamin Recovery from Natural Triglycerides
- Purification of Monoglycerides
- Isolation of Natural Oil Components
- Distillation, Decolorizing, Recovery
- Purification of Pharmaceuticals
- Removal of odors, colors and non-saponifiables from crude tall oil,

fatty acids and materials of higher molecular weights in general.

Results and savings are often startling. For example, a leading pharmaceutical manufacturer produces a tranquilizer from compazine base (a previous impossibility) using an Asco Molecular Still—weekly savings more than equal still cost, and the product is purer! . . . A French chemical producer distills electrical grade dioctyl phthalate of high quality on a commercial scale. . . . A U. S. company de-glycerinates glyceride mixtures with remarkable economy, just one of the separations and distillations of glycerides possible with Asco Molecular Stills.

Many more similar cases can be cited in which Asco Molecular Distillation has increased profits, improved results.

*Based on Recent Survey of Chemical Engineers



ARTHUR F. SMITH COMPANY
311 ALEXANDER ST. • ROCHESTER 4, N. Y.

✓ Check These Asco Features:

- ☐ Capacity Per Unit Practically Unlimited
- ☐ Present Personnel Can Operate
- ☐ Accelerated, Turbulent Film
- ☐ Shorter Exposure Time
- ☐ Minimum Pressure Drop
- ☐ Largest Possible Open Path

Test at Low Cost!

A laboratory size Asco Rota-Film Molecular Still is now available. This permits inexpensive tests accurately transferable to Asco industrial models. Price is \$391.

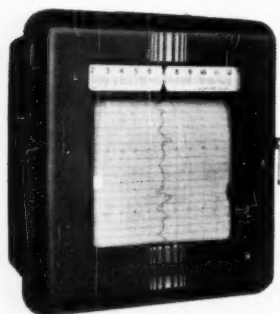
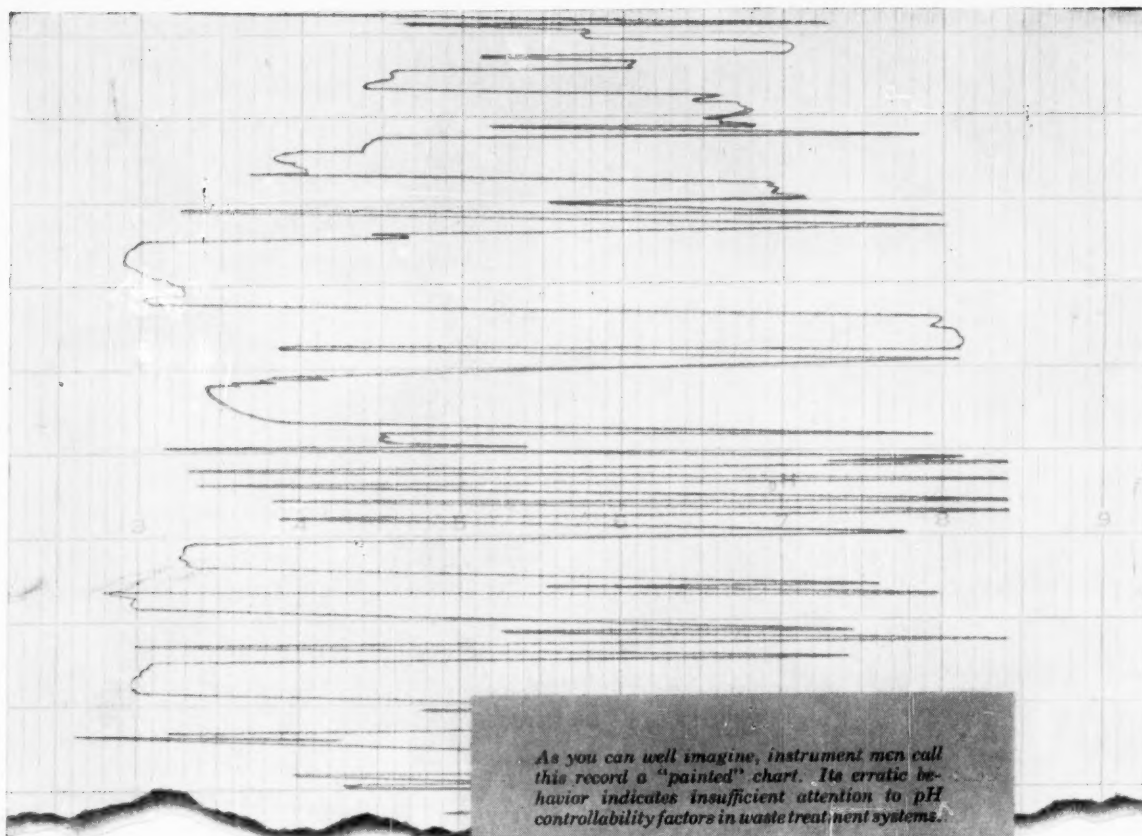


New Brochure

Fully Describes Models
and Applications

TEST RUN SERVICE

Now you can have test runs and limited custom distillation performed at ASCO's Rochester plant. Cost is \$125 per day. Write for complete details. Dept. C. E-1



FOR EFFICIENT WASTE TREATMENT

don't "paint" the chart!

In Any Given Waste Treatment System, the factors governing pH controllability—type of waste, variations in flow and concentration, layout and retention of the system, etc.—determine operational success. A painted chart may indicate that a system has been designed and instrumented without due regard to these factors, a regard which only L&N's pH Controllability Analysis provides.

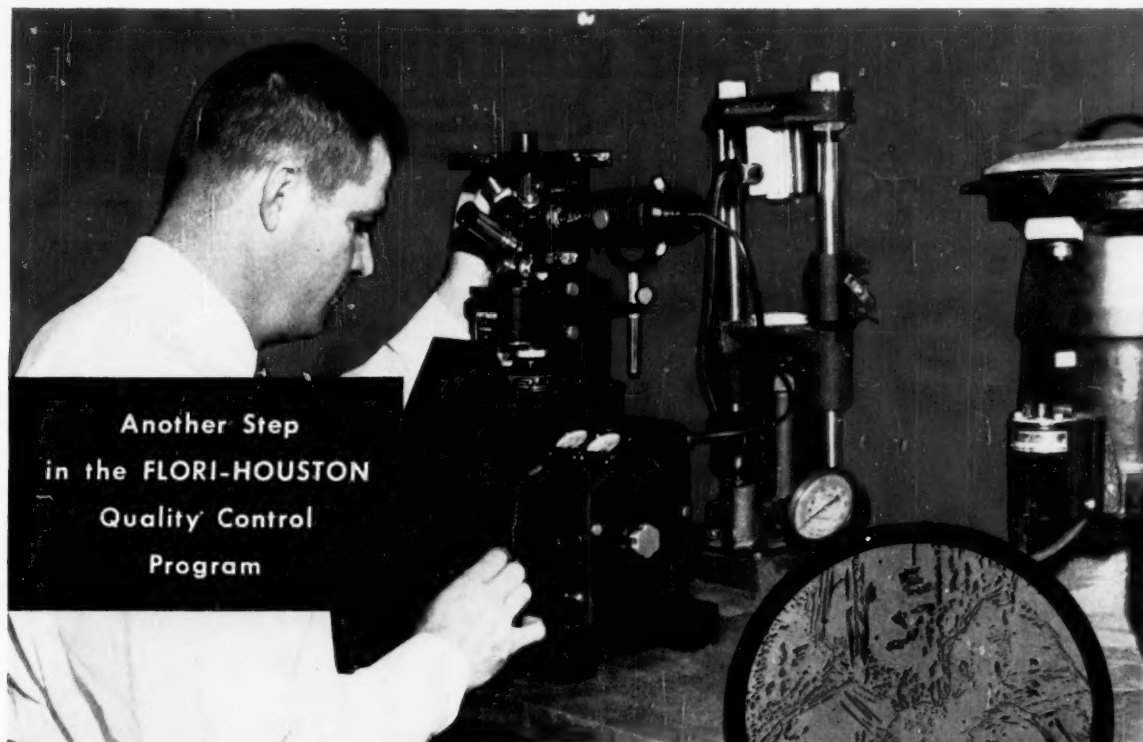
This unique Analysis gives us vital information about the controllability factors of individual waste treatment processes. Our engineers analyze these data to determine the limits within which the process can be controlled in a proposed treating system, or to recommend the physical layout

needed to gain the desired degree of control—the answers you need to achieve efficiency in industrial waste treatment.

Process Data Sheet 700(2), "L&N Speedomax Control of Plant Waste Disposal Processes", outlines this approach to industrial waste treatment. Write for a copy and you'll also receive a Controllability Analysis Questionnaire to fill out and return, without obligation, for concrete answers to your specific waste treatment problem. The address—4916 Stenton Ave., Phila. 44, Pa.

Jr'l. Ad. ND46-96(2)

LEEDS  **NORTHROP**
instruments automatic controls • furnaces



Another Step
in the FLORI-HOUSTON
Quality Control
Program

Radiology at FLORI-HOUSTON means better pipe fabrication

Human skills at Flori-Houston are matched with the most modern scientific equipment to insure pipe fabrication of the highest quality possible.

Shown above is a Flori-Houston research and development engineer examining a weld by microscope to study metallurgical structure. Example shown is an aluminum iron alloy for refinery service. This Flori-Houston procedure developed a completely corrosion resistant joint . . . without a backing ring.

Additional inspection of completed jobs is made with Brinnell, X-ray and Magnaflux equipment, to seek out hidden defects which might undermine the strength and dependability of the piping.

It is such strict measures that have made Flori-Houston fabrication synonymous with quality—quality that you can rely on for your fabrication needs.



FREE

Attractive illustrated 16-page booklet tells the story of Flori-Houston fabrication service. Illustrates equipment, fabrication processes and several interesting "case histories" of Flori-Houston fabrication jobs. Write for your free copy today.

GENERAL OFFICE

subsidiaries of
SPARTON CORPORATION

THE FLORI PIPE CO.

601 E. RED BUD • ST. LOUIS 15, MISSOURI

HOUSTON OFFICE

HOUSTON PIPE & STEEL, INC.

P. O. BOX 2 • HOUSTON 1, TEXAS

No Guesswork When Laboratory Crushing or Grinding is Done by Sturtevant Machines

"Open-Door" Design Provides Quick Access for Cleanout — Guarantees Accurate Samples



In a matter of seconds, because of hinged access doors, all crushing or grinding parts are exposed for thorough cleanouts — 100% accuracy in sampling.

Design of Sturtevant laboratory machines is based on production models. Higher output — to scale with actual production quality and output, is built into each machine. Add rugged construction and you have a machine that keeps on top of lab or pilot work.

Preferred by laboratories that

demand accuracy and dependability in test or pilot runs, Sturtevant laboratory machines have long been used by the 'blue chips' of industry and education. Names on request.

Send for Bulletin 067, which gives full description of all Sturtevant laboratory machines. (Bulletins are also available on Production Crushers, Grinders, Blenders, Air Separators, Micronizers and Automatic Coal Sampler.) Write Sturtevant Mill Company, 100 Clayton St., Boston 22, Mass.



SWING-SLEDGE MILL RETIRES AFTER 25 YEARS...

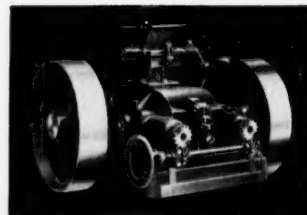
Ruggedness of Sturtevant machinery is well-known in industry, where even laboratory-size Sturtevant units are sometimes used for round-the-clock production.

Jas. F. Morse Co., Boston, recently replaced their small-size Swing-Sledge Mill, which had been doing production grinding for 25 years. It was used to grind $\frac{3}{8}$ in. tannage into bone meal. Repairs in 25 years? "Just grates and hammers," reports Plant Manager W. Carleton Merrill.

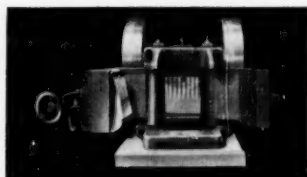
STURTEVANT Dry Processing Equipment

The "OPEN-DOOR" to lower operating costs over more years

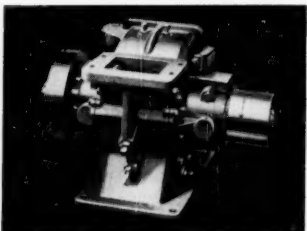
CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS



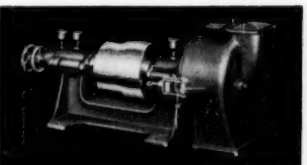
Lab Crushing Rolls: Specially designed for laboratory sampling, Crushing Rolls come in two sizes: 8 x 5 in. and 12 x 12 in. Capacities run as high as 10 tons per hour. Automatic adjustments: 8 x 5 in. model adjusts from $\frac{1}{8}$ in. to 20 mesh; 12 x 12 in. model from $\frac{3}{4}$ in. to 20 mesh. Tires are high carbon forgings and extra tough. Feeder is automatic, adjustable.



Lab Jaw Crusher: Full or part-time duty for crushing hardest rocks: 2 x 6 in. opening. Jaw Crushers have roll jaw action — no clogging. Hard rock capacities: $\frac{1}{2}$ in. setting — 1900 pounds per hour; $\frac{3}{4}$ in. setting — 1200 pounds per hour; 1 in. setting — 800 pounds per hour. Instant in-operation adjustment. Jaw Crushers have manganese steel jaw plates, reversible shields, steel pitman, anti-friction bearings.



Lab Swing-Sledge Mill: 5 x 6 in. feed opening takes soft, medium, tough or fibrous material. Capacity to 1 ton per hour, fines regulated from 1 in. to 20 mesh. Single-pass limestone grinding produces 99.8% 10 mesh fines, 95.8% 20 mesh. Single-pass bituminous coal pulverizing gives 99.9% 10 mesh fines, 91% 20 mesh. Choice of gratings, hammers (or knives).

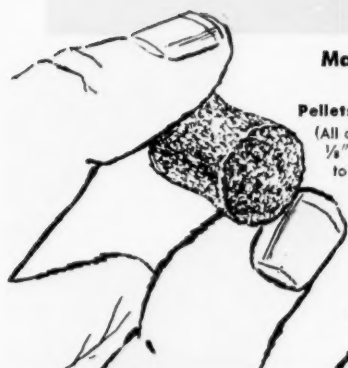


Sample Grinder: Disc type grinders for dry, friable, soft or medium materials. Three sizes — 6 in., 10 in. and 14 in. take feed as coarse as $\frac{1}{4}$ in. 100 mesh fines at rates to 200 pounds per hour on largest model. Product regulates from 10 to 100 mesh. In-operation adjustment.

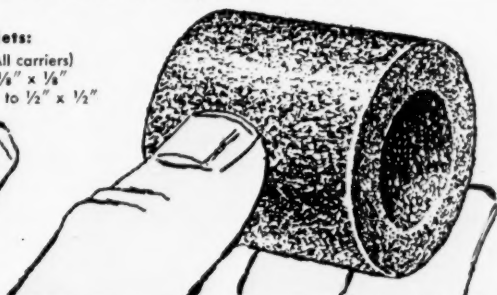
ALUNDUM* Catalyst Carriers and Supports

are proved aids to better,
lower cost processing

Made In These Shapes And Sizes



Pellets:
(All carriers)
 $\frac{1}{8}$ " x $\frac{1}{8}$ "
to $\frac{1}{2}$ " x $\frac{1}{2}$ "



Spheres:
(Low surface area)
 $\frac{3}{16}$ " to $\frac{1}{2}$ " diameter
(Intermediate surface area)
 $\frac{1}{4}$ " to $\frac{1}{2}$ " diameter

Rings:
(All carriers)
 $\frac{1}{8}$ " x $\frac{1}{4}$ " to $\frac{3}{8}$ " O.D.
to 1 " x $1\frac{1}{2}$ " x $1\frac{1}{2}$ " O.D.

Norton ALUNDUM catalyst carriers have excellent mechanical, thermal and chemical stability. They are crystalline in nature and are produced in two surface area types: Intermediate ($5-70\text{m}^2/\text{gram}$) and Low (less than $1\text{m}^2/\text{gram}$).

The alumina content of the intermediate carriers is approximately 77%. These are subdivided into Types A, B and C, with varying characteristics. In the low surface area carriers, the alumina content ranges from 77% to 92%.

PHYSICAL PROPERTIES

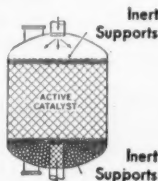
	Apparent Porosity	Water Absorption	Bulk Density	Vol. Bulk Density	Crystal Structure	Surface Area
Intermediate Surface Area Type A	45-50%	28-30%	1.65-1.70 gr/cc	58 lbs/ft ³ (Approx.)	Quartz, Alpha, Gamma Alumina — chiefly Gamma Alumina	60-70m ² /gram
Type B	45-50%	28-30%	1.65-1.70 gr/cc	60 lbs/ft ³ (Approx.)	Quartz, Alpha, Gamma, Kappa, Delta Alumina	20-30m ² /gram
Type C	45-50%	28-30%	1.65-1.70 gr/cc	62 lbs/ft ³ (Approx.)	Alpha Alumina and Mullite	5-10m ² /gram
Low Surface Area	10-50%	3-25%	1.90-3.15 gr/cc	65-80 lbs/ft ³	Alpha Alumina and Mullite	Less than 1m ² /gram

Some Of Many Applications

Suggested Applications For Intermediate Surface Carriers include catalytic reforming, dehydrogenation, dehydration, sulfuric acid manufacture, nitric acid manufacture and dessicants.

Low Surface Area Carriers are used in the processing of phthalic anhydride, maleic anhydride and ethylene oxide; also in protective atmospheres and synthetic gas generation.

Suspending
Active
Catalysts
Effectively



In fixed bed converters where it is necessary to suspend active catalysts at a given level, supports produced by Norton are used successfully. Made of dense, rugged, electrically fused materials these supports have great resistance to breakdown and have no chemically reactive effect on the processing.

Get More Facts

on how Norton catalyst carriers and supports can improve and economize your processing. On request, they can be prepared from other materials such as: CRYSTOLON* silicon carbide, MAGNORITE* fused magnesia, zirconium oxide, silica, etc. Call in your Norton Refractories Engineer or write, mentioning your requirements, to NORTON COMPANY, Refractories Division, 500 New Bond St., Worcester 6, Massachusetts.

NORTON
REFRACTORIES
Engineered... R_x ... Prescribed

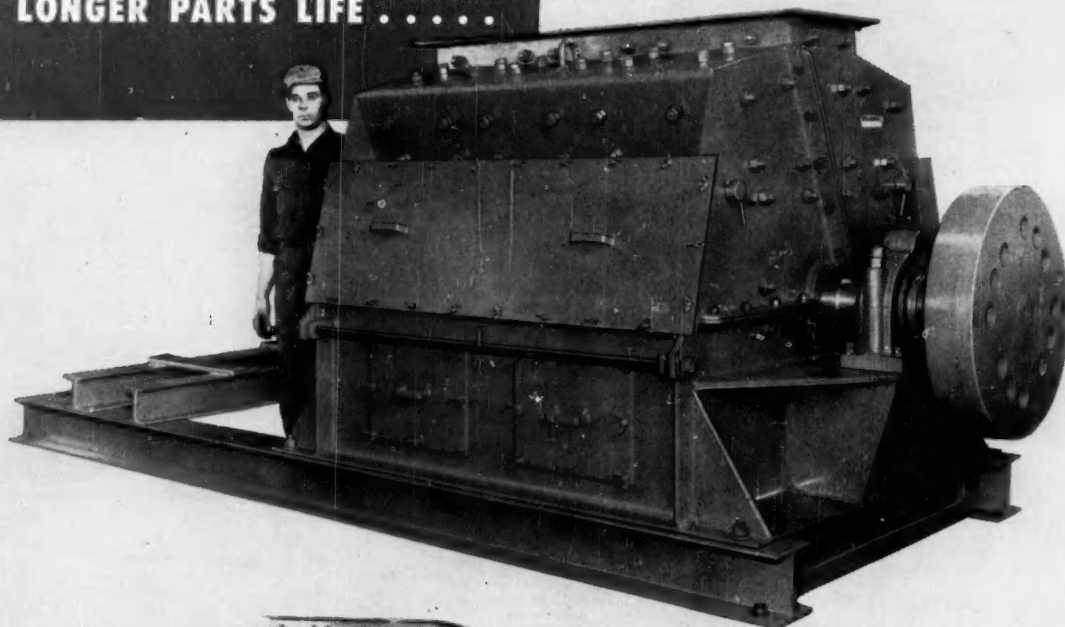
Making better products...
to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS:
Coated Abrasives • Sharpening Stones
Behr-cat Tapes

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

NEW
DUAL "2-POINT"
ADJUSTMENT INSURES
MORE UNIFORM GRINDING,
LONGER PARTS LIFE

WILLIAMS
Reversible
HAMMER MILLS



Williams Reversible Hammer Mill with cover open.
 Note these features:

- Super-strong reinforced steel plate frame
- Renewable wear-resistant manganese steel liners
- Heavy duty oversize forged steel rotor shaft
- Anti-friction self-aligning roller bearings in dust-tight housings
- Complete accessibility to interior for quick parts changing

It's another Williams "first"—features not available in other hammer mills—that now makes it possible to maintain the original close clearances of *both* grinding plates *AND* cage sections against the rotating hammers. This easy-to-make "2-point" adjustment, in the most critical grinding area inside the hammer mill, gives absolute assurance of consistently uniform product quality.

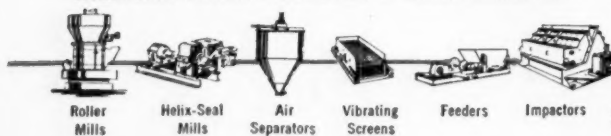
In addition to the advantages of the Dual "2-Point" Adjustment, a Williams Reversible Hammer Mill substantially lowers upkeep expense by

WILLIAMS PATENT CRUSHER & PULVERIZER CO.

cutting hammer cost. Hammers can be operated in one direction today and another tomorrow simply by installing a simple reversing switch on the driving motor. Manual reversing of hammers no longer necessary. Grate bars also last longer. The double set of reversible manganese breaker plates, which last twice as long as other types, give four times the service! Maintenance and downtime are cut 50% or more.

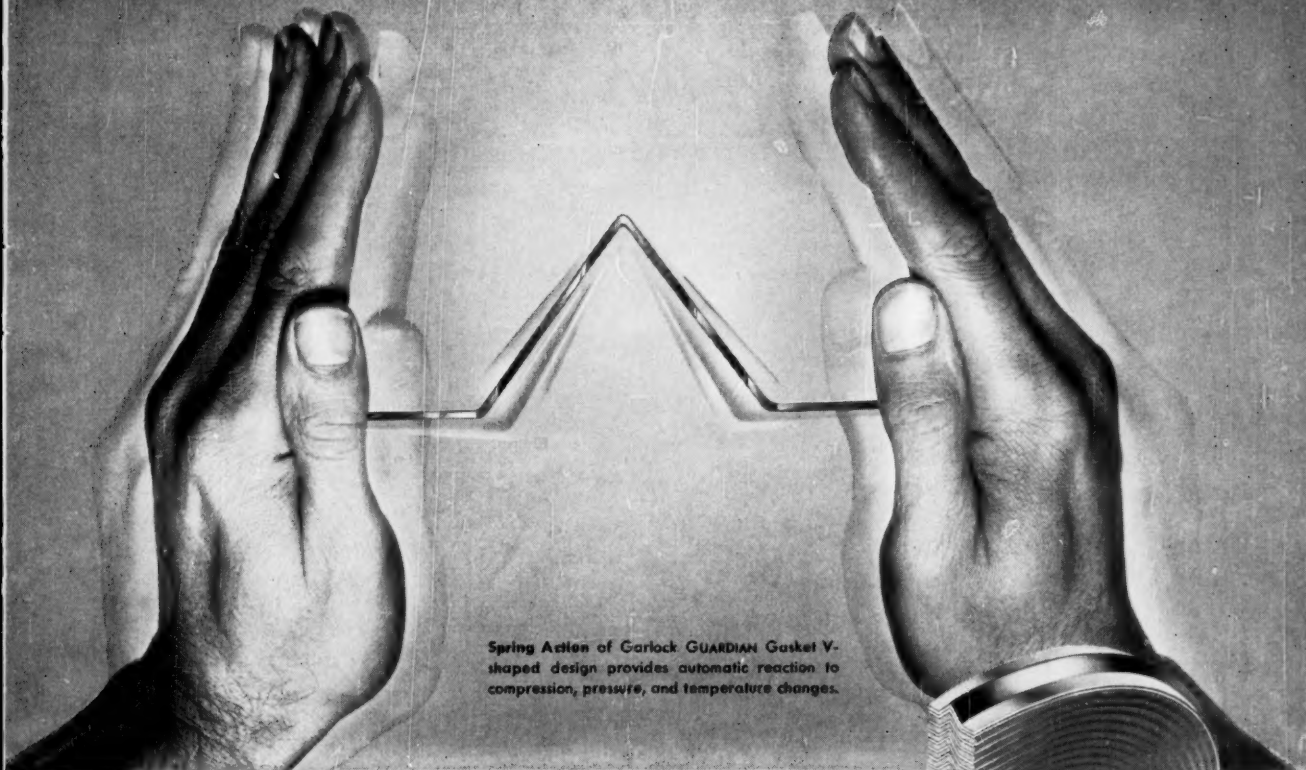
Get all the facts about the hammer mill with ALL the top features.

• 2706 N. Ninth St. • St. Louis 6, Mo.



WILLIAMS
CRUSHERS GRINDERS SHREDDERS
 Oldest and Largest Manufacturers of Hammer Mills in the World

ONE OF THE GARLOCK 2,000



Spring Action of Garlock GUARDIAN Gasket V-shaped design provides automatic reaction to compression, pressure, and temperature changes.

ACCURATELY CONTROL COMPRESSION

WITH GARLOCK SPIRAL WOUND

GUARDIAN* GASKETS

Safe, positive sealing at highest temperatures and pressures, and under lighter bolt loads, is assured with Garlock GUARDIAN Gaskets. In no other type gasket can you vary the compressibility to meet different pressure requirements and established bolt loads. This is done by increasing or decreasing the number of layers of metal and asbestos paper (or Teflon). Compressibility can be controlled also by hardness and resiliency of the metal used. 304 stainless steel is used in standard construction. Other types of steel are also available when required. GUARDIAN Gaskets are recommended for use against steam, oils, gases, liquids including most chemicals at temperatures to 1050° F and pressures to 2500 psi.



Garlock GUARDIAN Gaskets are made to Military Specifications and constructed of spiral wound strips of V-shaped metal alternated with layers of asbestos paper or Teflon. The type metal and filler depend upon the application.

GUARDIAN Gaskets are another important part of the famous "Garlock 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet all your needs. The *only* complete line. That's why you get unbiased recommendations from your Garlock representative. Call him or write for new GUARDIAN Gasket Catalog AD-104.

*Registered Trademark

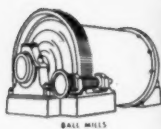
THE GARLOCK PACKING COMPANY, Palmyra, N.Y.

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.

GARLOCK



Packings, Gaskets, Oil Seals, Mechanical Seals,
Rubber Expansion Joints, Fluorocarbon Products



BALL MILLS



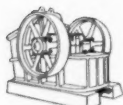
ROTARY KILNS



APRON FEEDERS



PRIMARY GYRATORY CRUSHERS

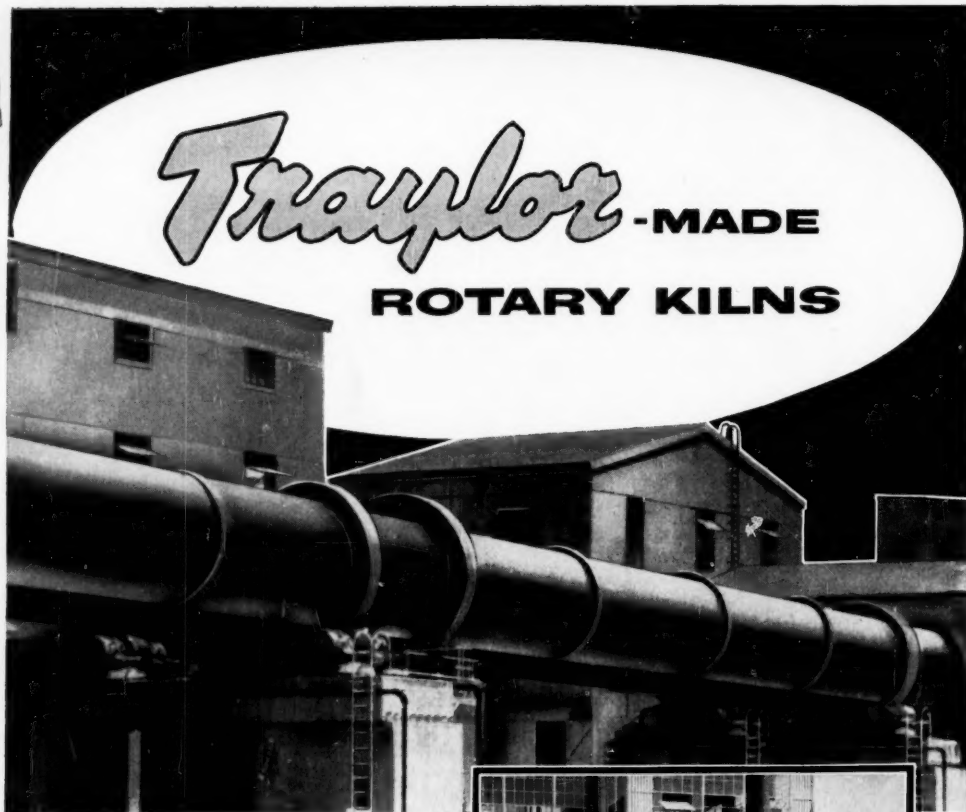


JAW CRUSHERS

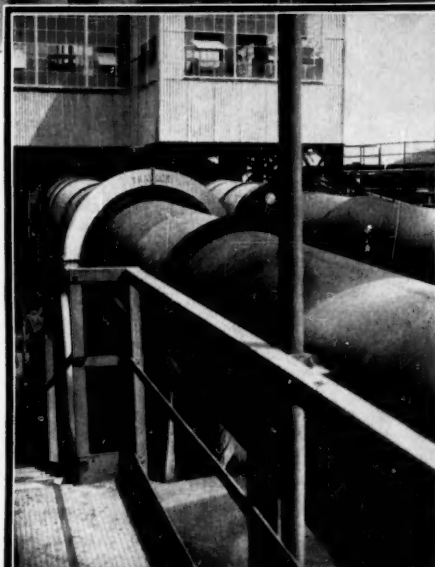


SECONDARY GYRATORY CRUSHERS

Traylor -MADE ROTARY KILNS



Traylor engineers have improved rotary kiln performance with single support type roller bearings insuring easy alignment and low maintenance. Traylor kilns have all welded steel shells, feed and discharge end seals, improved kiln feeders and many other innovations that reflect the high standards of Traylor craftsmanship. For information on Traylor Rotary kilns, coolers and dryers write for Bulletin No. 1115.



Traylor Rotary Kiln operating in a paper mill.

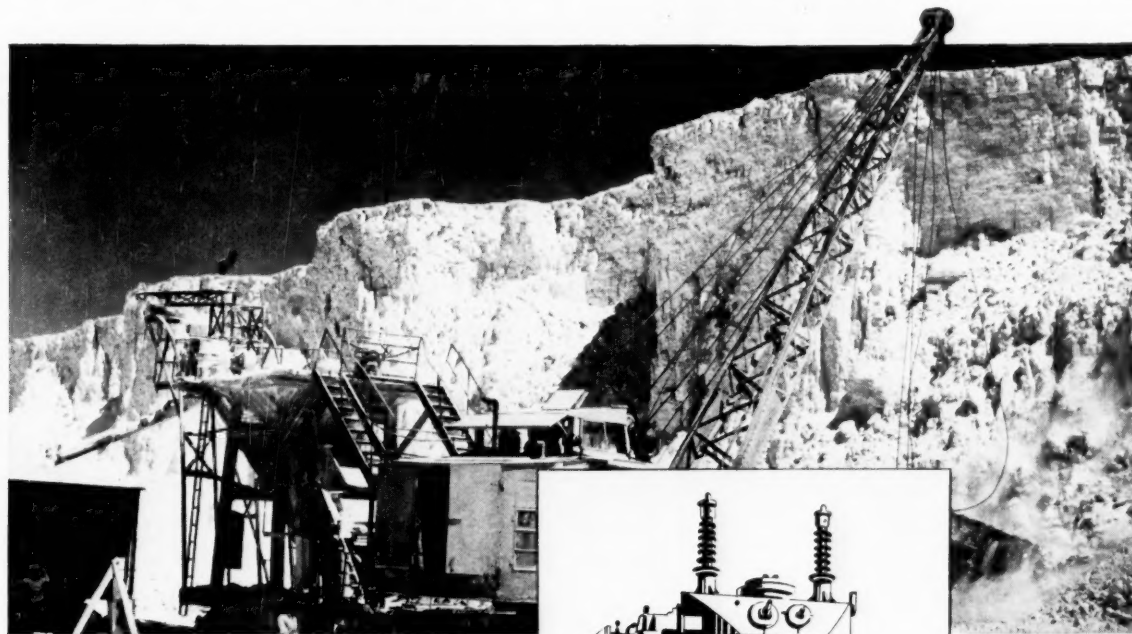
Traylor

TRAYLOR ENGINEERING & MFG. CO. 1000 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

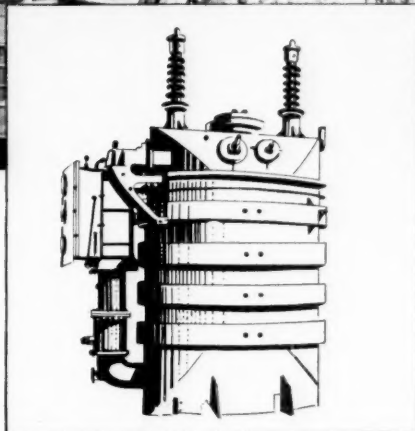
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

SULPHUR *helps to create Headline Products*



SF₆

*A new concept in
transformer
insulation*



GAS INSTEAD OF OIL... *that is headline news!*

Sulphur Hexafluoride is a heavy, non-flammable gas and is both chemically and physiologically inert. These characteristics plus its high dielectric strength pin-pointed the heavy duty transformer field as a logical target. And so it turned out!

SF₆ instead of oil is now being used in high voltage transformers with the following advantages:

- operations are much quieter
- lighter construction permissible
- less restriction in location
- lower maintenance
- fire-proof and explosion-proof

In SF₆, the electrical and electronics industries are finding a very useful product providing both electrical insulation and cooling. As in so many 'headline' products serving industry, the element S is part of the chemical structure!



Texas Gulf Sulphur Co.

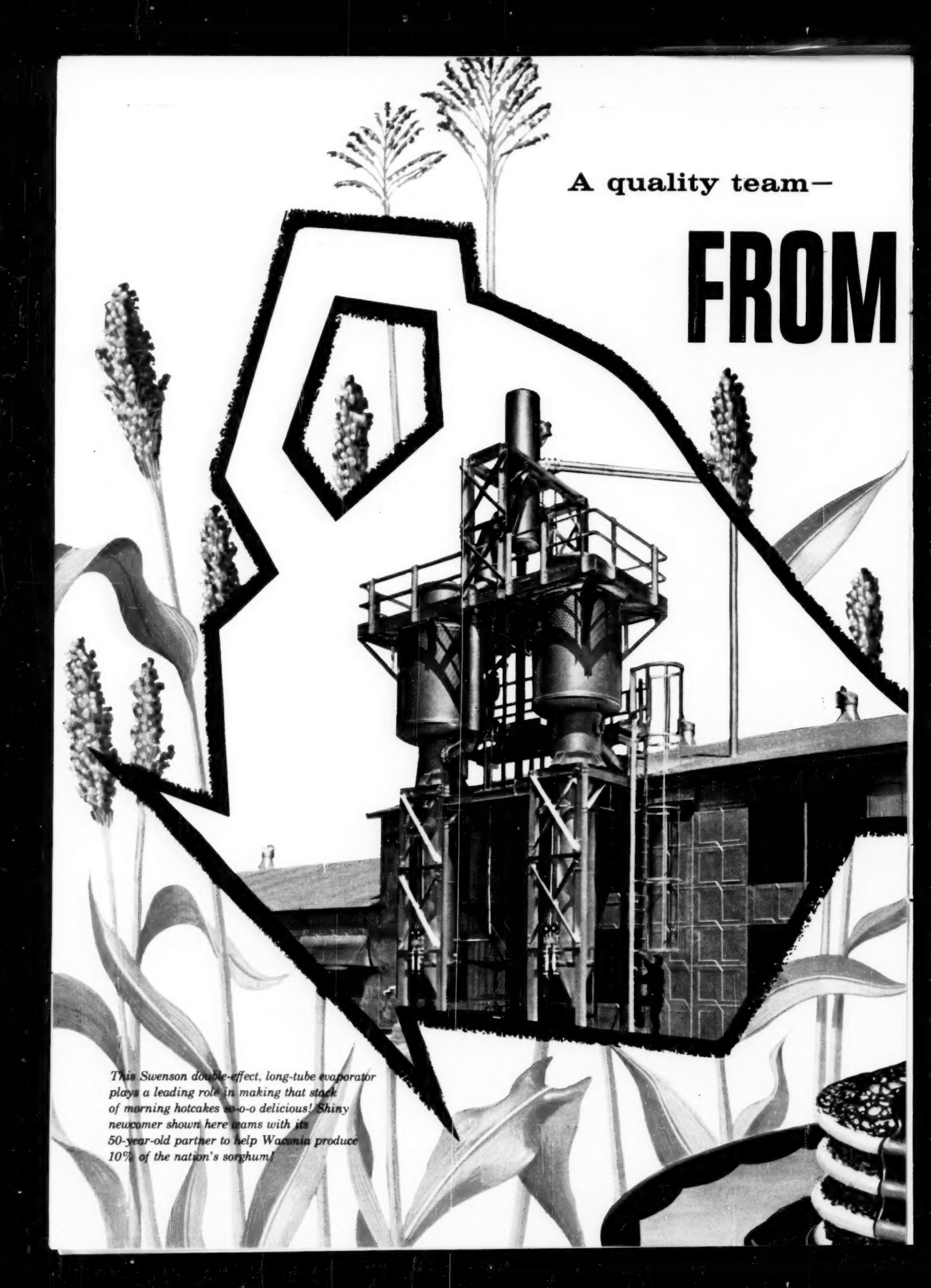
75 East 45th Street, New York 17, N.Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units

- Newgulf, Texas
- Spindletop, Texas
- Moss Bluff, Texas
- Worland, Wyoming

A quality team—

FROM



This Swenson double-effect, long-tube evaporator plays a leading role in making that stack of morning hotcakes so-o-o delicious! Shiny newcomer shown here teams with its 50-year-old partner to help Waconia produce 10% of the nation's sorghum!

SEED...TO SWENSON ...TO SORGHUM

Producers of nearly one tenth of the nation's sorghum, Waconia Sorghum Company of Cedar Rapids, Iowa, places special emphasis on quality as well as quantity. In 1915 Waconia developed a better-than-natural sorghum seed, forerunner of the millions now sown annually in its 1,500-acre field.

To maintain quality from harvest through processing, Waconia has long relied on Swenson Evaporators. The original evaporator has performed faithfully for half a century, a potent testimony to Swenson planning, engineering and post-installation service. Its new helpmate—installed in 1956—has already made its mark as an integral part of Waconia's continuous program for producing quality sorghum that's second to none!

Food, chemical, pharmaceutical... whatever your processing need, there's a custom-designed, custom-engineered Swenson Evaporator for you. Consult a Swenson engineer... learn why a Swenson Evaporator should be a member of your production team.

Send for "An Open Door,"

the 12-page brochure showing how Swenson engineering assists in solving so many evaporation, crystallization, filtration, pulp washing, and spray drying problems. Whatever your title—President, Manager, Engineer, Chemist—send for this informative, all-interesting idea booklet, today! Swenson Evaporator Company, 15667 Lathrop Ave., Harvey, Illinois.



SWENSON

Proved Engineering for the Process Industries

Since 1889





Barber-Coleman



Bendix-Westinghouse
Rotochamber



Coneflow



Fisher Governor



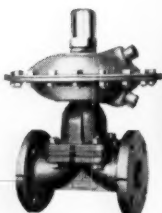
Foxboro
Reversible Stabillo



General Controls
Hydramotor



Grinnell Air Motor,
Spring Loaded



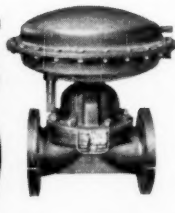
Grinnell Air Motor,
Double-Acting

GRINNELL- SAUNDERS DIAPHRAGM VALVES

with famous name
POWER OPERATORS



Grinnell Piston



Hammel-Dahl
Close-Coupled



Hammel-Dahl
Preloaded



Kieley & Mueller



Mason-Neilan



Minneapolis-Honeywell



Philadelphia Gear
Limitorque



Taylor Motosteel

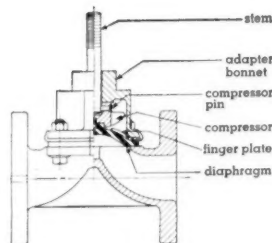
GRINNELL-SAUNDERS Diaphragm Valves are easily equipped for power operation — by combining any of numerous power operators, a sliding stem bonnet assembly, and a valve body. The sliding stem bonnet can be modified to accommodate any make of power operator, pneumatic or electric.

Grinnell-Saunders Diaphragm Valves are unsurpassed for handling materials as diversified as corrosive fluids, gases, beverages, foods . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

The operating principal of the Grinnell-Saunders Diaphragm Valve is simple. The resilient, flexible diaphragm is lifted high when the compressor is raised and pressed tight against the body weir when the compressor is lowered.

Grinnell valves are available with body, lining, and diaphragm materials to meet different service conditions. For further information, write Grinnell Company, Inc., 291 West Exchange St., Providence, R. I.

This sliding stem bonnet is specially designed for power operation. The power operator is attached to the adapter bonnet and to the threaded end of its free-sliding stem. Thus, the operating force is applied *directly*. The stem, in turn, is directly connected to the compressor which opens and closes the valve when power is applied. This sliding stem bonnet is interchangeable with other bonnet designs.



GRINNELL

WHENEVER PIPING IS INVOLVED

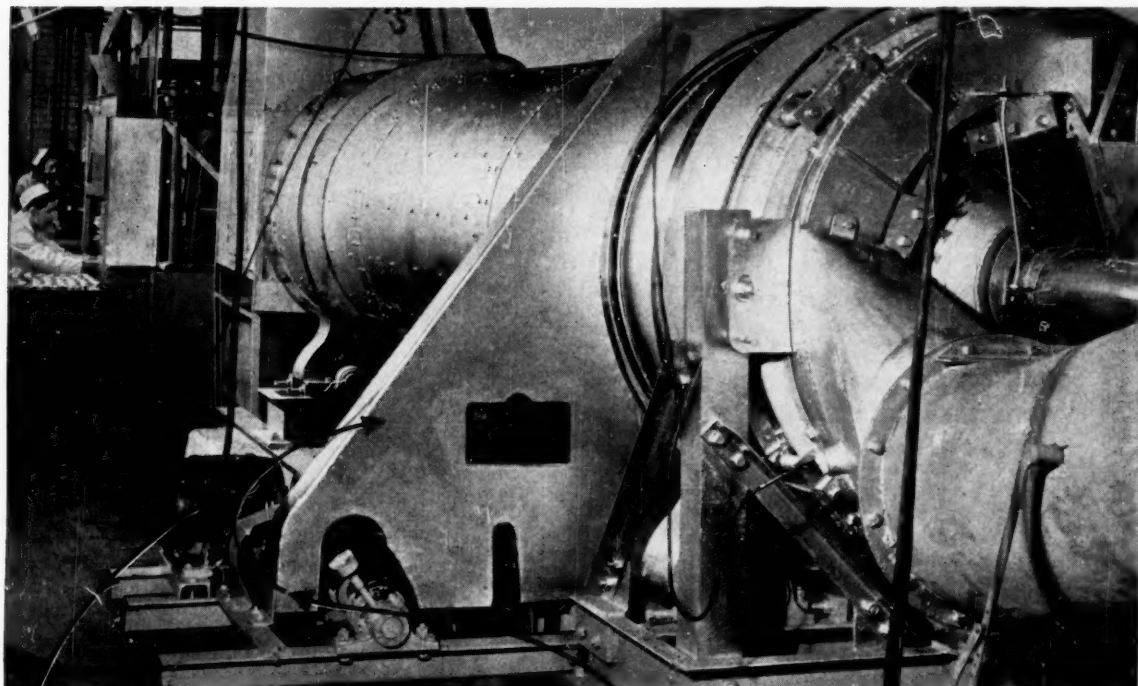


Grinnell Company, Inc., Providence, Rhode Island

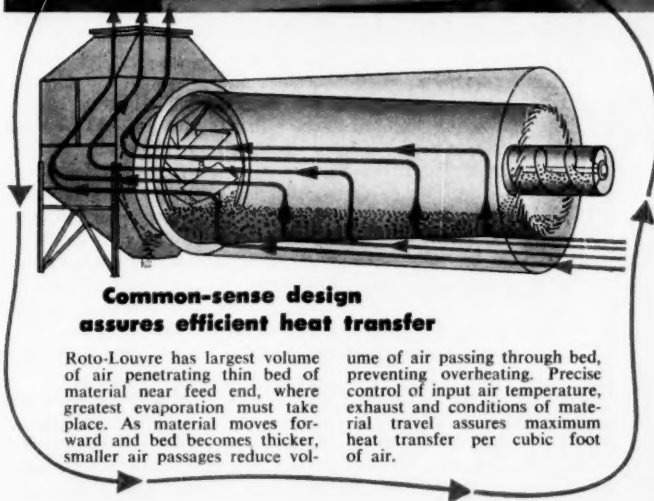
Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Why the LINK-BELT Roto-Louvre dryer can mass-produce your product with laboratory accuracy



Where rapid, continuous processing and product uniformity are essential—as in processing organic materials (above)—Roto-Louvre's efficient heat transfer excels.



Common-sense design assures efficient heat transfer

Roto-Louvre has largest volume of air penetrating thin bed of material near feed end, where greatest evaporation must take place. As material moves forward and bed becomes thicker, smaller air passages reduce vol-

ume of air passing through bed, preventing overheating. Precise control of input air temperature, exhaust and conditions of material travel assures maximum heat transfer per cubic foot of air.

Gentle handling controls quality as precisely as your pre-forming methods

If you find your product's quality varying seriously from test sample results, check your dryer. Chances are, you need the precise control and uniform processing the Link-Belt Roto-Louvre offers.

This compact, effective machine introduces dry, heated air through ever-changing channels, assuring uniform drying of the entire surface of each particle. Even friable materials or those tending to case-harden are handled successfully without sacrificing thermal efficiency or volume.

Roto-Louvre is one of several types of Link-Belt dryers. Our engineers will recommend the right one for your needs . . . or test a sample of your product in our modern laboratory.

LINK-BELT

DRYERS • COOLERS • ROASTERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1, Ill. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarborough (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

14, 56 S



LINK-BELT COMPANY

Prudential Plaza, Chicago 1, Ill.

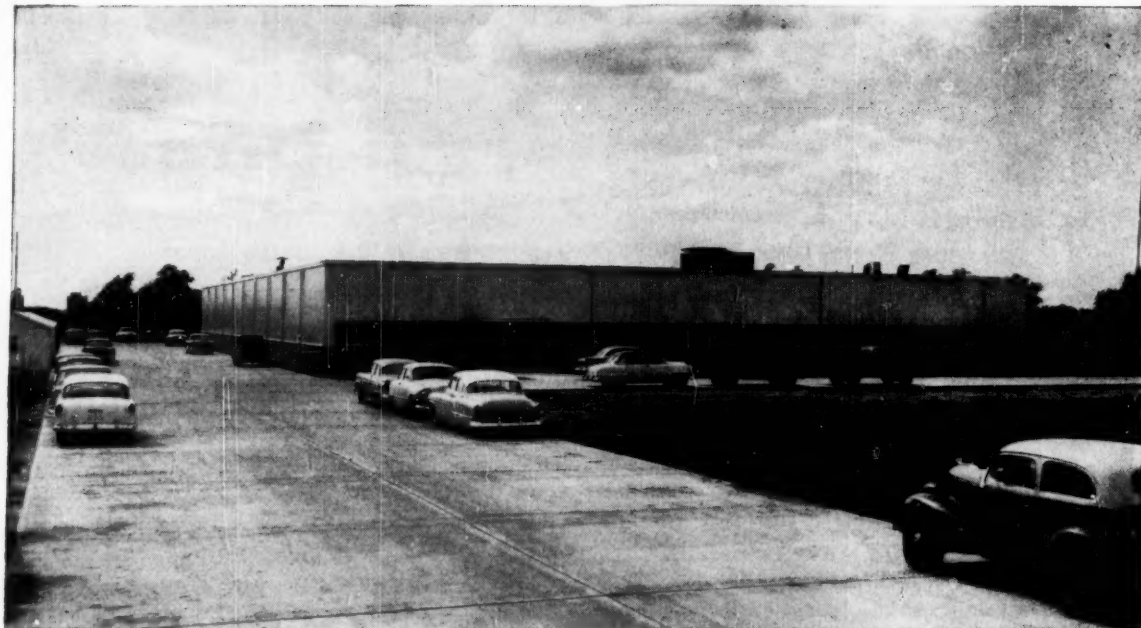
Please send me 20-page Roto-Louvre Book 2511.

Name

Firm

Address

City.....Zone...State.....



SANDWICH WALLS OF ALCOA ALUMINUM...

your low-cost answer to corrosion

The new Schlumberger Well Surveying Corporation building for Johnson Testers, Inc. in Sugarland, Texas puts aluminum to the acid test. It's located in the hot, humid, salt-laden atmosphere of the Gulf of Mexico. Aluminum sandwich walls assure lasting protection against corrosion. Their reflectivity and insulating effect lighten the air-conditioning load. Engineers and builders: The Austin Company, Houston, Texas. Alcoa Approved Applicator: Jamar-Olmen Construction Co., Houston, Texas.



Nothing eats into profits more relentlessly than corrosion. But sandwich walls of Alcoa® Aluminum are an effective, low-cost answer to this problem. They're immune to corrosion, whether from acid or alkaline fumes, salt atmospheres, humidity or chemical-laden industrial atmospheres. They stay good-looking longer and never lose their strength.

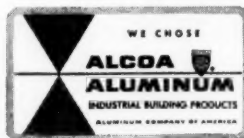
Surprisingly, you pay less for sandwich walls of Alcoa Aluminum. It is, in fact, the lowest cost, insulated metal wall system known! Aluminum's lighter weight permits lighter, less expensive foundations and framing, speeds erection and painting is eliminated once and for all—aluminum never needs it—saves many, many dollars throughout the years.

Walls can be moved and re-used during expansion and remodeling. What's more, aluminum's corrosion resistance serves just as effectively on windows, gratings, pipes, ductwork and other mill fixtures. Get all the facts from your nearest Alcoa sales office, or write Aluminum Company of America, 856-A Alcoa Building, Pittsburgh 19, Pa.



"ALCOA THEATRE"

Exciting Adventure—Alternate Monday Evenings



**Your Guide to the Best
in Aluminum Value**

Replace with **PULSAFEEDER** for Trouble-Free Liquid Metering

NO LEAKAGE
NO CONTAMINATION
NO PRIME LOSS
NO STUFFING
BOX

When the time comes to replace the chemical pump in your process, replace with a PULSAFEEDER—the *leak-proof* chemical pump that has *no stuffing box* or other leak-likely seal.

Lapp Pulsafeeder is a combination piston-diaphragm pump... positive displacement is achieved by a reciprocating piston pumping a hydraulic oil against a diaphragm. This hydraulically balanced diaphragm isolates the liquid being pumped from the pump's working parts—eliminates need of stuffing box or running seal—prevents product leakage and contamination. Pumping speed is constant, variable flow results from variation in piston-stroke length... controlled manually by hand-wheel, or, in Auto-Pneumatic models, by instrument air pressure responding to any instrument-measurable process variable.

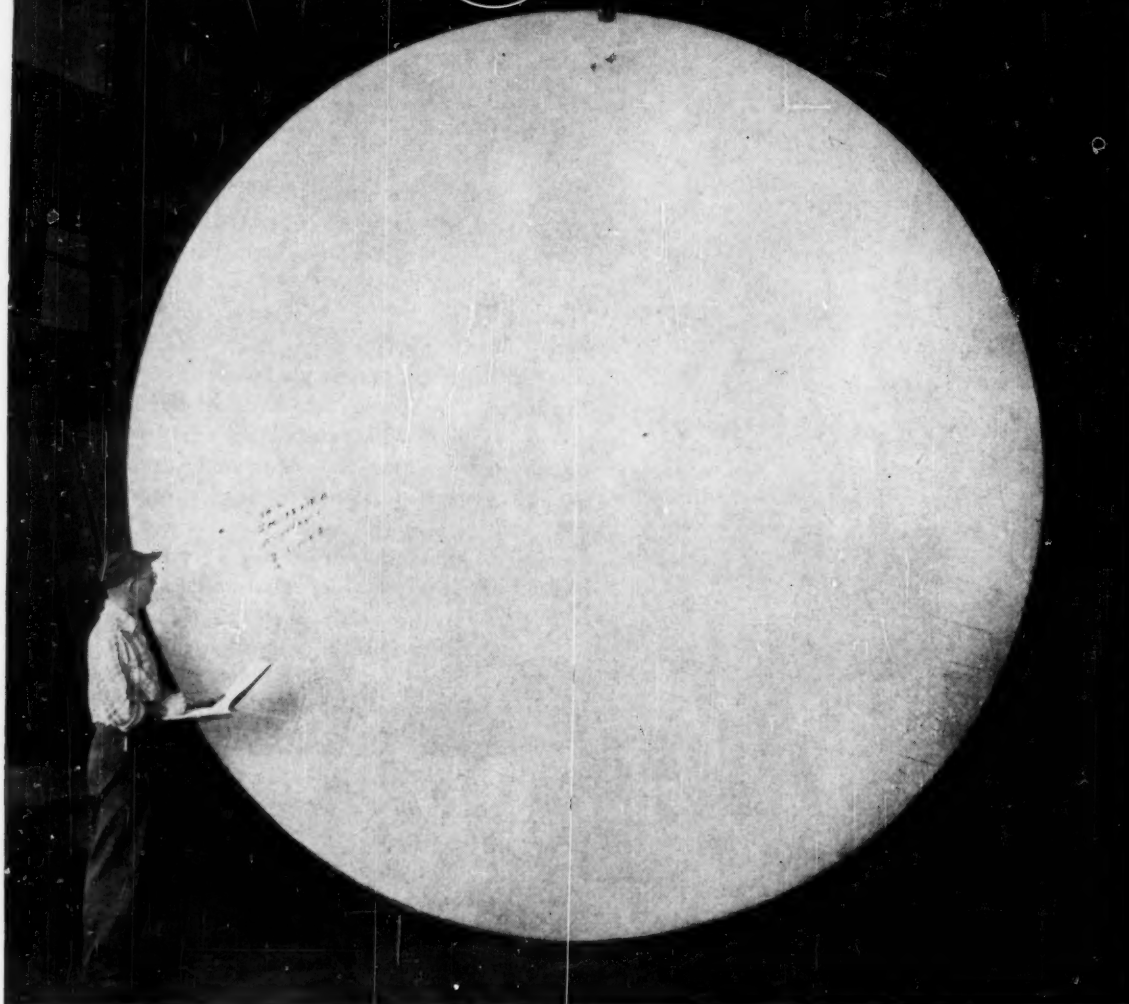


Lapp

WRITE FOR BULLETIN 440
with typical applications, flow
charts, description and specifica-
tion of models of various
capacities and constructions.
Inquiry Data Sheet included from
which we can make specific
engineering recommendation for
your processing requirement.
Write Lapp Insulator Co., Inc.,
Process Equipment Division, 577
Poplar Street, Le Roy, N. Y.

Lapp
PULSAFEEDER
CONTROLLED-VOLUME
CHEMICAL PUMP

WHY BUY STAINLESS STEEL squares WHEN IT'S circles YOU NEED?



This circle, $\frac{3}{16}$ " thick x 164" diameter, is one piece of Type 316L stainless steel. Had the customer ordered a square, he would have paid freight on a half-ton of excess material. Also, he would have had the problem and expense of handling the square and cutting the circle.

Here are four sound reasons why Carlson customers save time and money when they order the circles they want—rather than the squares they have to cut . . .

1. If the gauge and size are circle-shearable, there is no extra charge for cutting the circle. This saves cutting labor and scrap handling expense.
2. If the gauge is such that a cutting charge applies to the square, it pays

to order the circle. This eliminates the extra charge for cutting the original square and involves only the one charge for cutting the circle.

3. Because circles weigh approximately

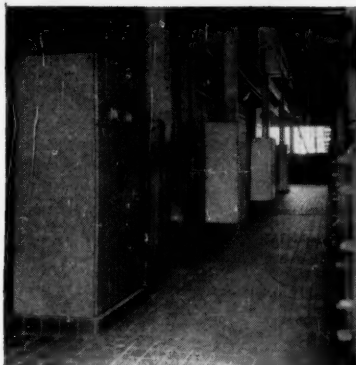
25% less than squares, there's a substantial saving in transportation costs.

4. Small or medium size circles are often available from stock when squares may not be. The delivery time saved can be an important factor.

When you need stainless steel circles, come to Carlson where we specialize in stainless steel . . . that's your guarantee of dependable service.

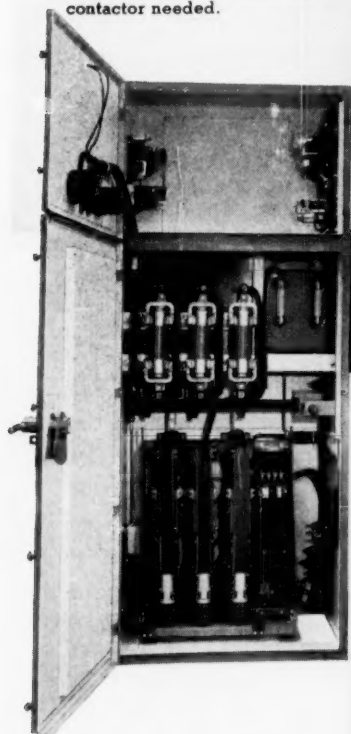
Stainless Steels Exclusively
CARLSON Inc.
THORNDALE, PENNSYLVANIA
District Sales Offices in Principal Cities

Plates • Plate Products • Forgings • Bars • Sheets (No. 1 Finish)

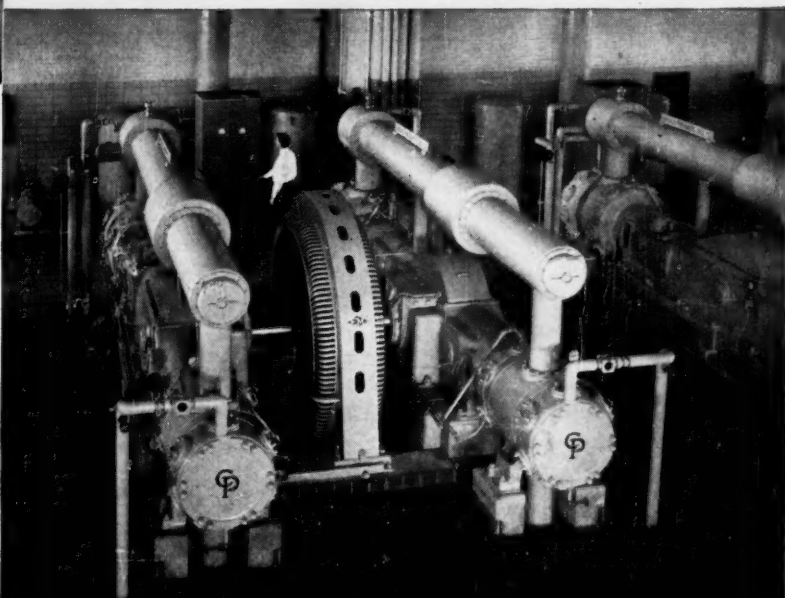


Above and at right • Four EC&M 1000 HP, 2300 Volt Synchronous Starters on air-compressor drives in Chrysler Corporation's new Ohio Stamping Plant at Twinsburg. Purchased and installed by Hatfield Electric Co., Cleveland, Ohio.

Below • Inside view of starter showing compact arrangement of fuses and contactor. The three arc shields slide out for quick access to both front and rear contacts—no draw-out of contactor needed.



The most complete synchronous motor protection you can buy



EC&M 2200-4800 VOLT STARTERS

• A push of the "start" button gives you complete protection during starting and running—*plus EC&M fully automatic synchronization*. Throughout the entire sequence, motor windings are completely protected and synchronization occurs at the most favorable time. Should the motor pull out of step because of voltage dip or overload, the field is automatically removed. Re-synchronization occurs when the motor re-accelerates the load. Short circuit protection is provided by current-limiting power fuses working in conjunction with EC&M's "certified" high-interrupting-capacity ZHA air-break contactor.

For complete details...

WRITE FOR BULLETIN 8210



THE ELECTRIC CONTROLLER & MFG. CO.

A DIVISION OF THE SQUARE D COMPANY
CLEVELAND 28 • OHIO

8897

The last word on VAPOR COMPRESSION EVAPORATORS

From:
Cleaver-Brooks Company
Special Products Division
225 Grand Avenue
Waukesha, Wisconsin



Here's the low-cost answer to your pure water problems. Cleaver-Brooks units are famous for economical operation, produce distilled water for energy-cost as low as 51 cents per thousand gallons.

Fresh water from the sea or brackish wells for municipal use in desert areas . . . Cleaver-Brooks vapor compression units produce pleasant tasting water. Thousands field-proven for dependability and efficiency. Capacities range from 1000 to 50,000 gallons per day.

Pharmaceutically pure water — Vapor compression is especially suited to producing pyrogen-free water for pharmaceutical applications or industrial water distilling. Cleaver-Brooks now serves leading laboratories.

Concentration of radioactive wastes — Special designs available for concentrating radioactive wastes. Over 99.99% of the radioactivity is retained in the sludge.

Cleaver-Brooks offers many types of units engineered to answer "concentration-for-recovery-or-disposal" problems in chemical and processing industries.

CLEAVER-BROOKS COMPANY, Special Products Division
225 Grand Ave., Dept. CE18, Waukesha, Wisconsin

- ☐ Please send me your Vapor Compression Catalog
☐ I would like to discuss evaporation problems with a Cleaver-Brooks sales engineer

Name
Firm
Street address
City State

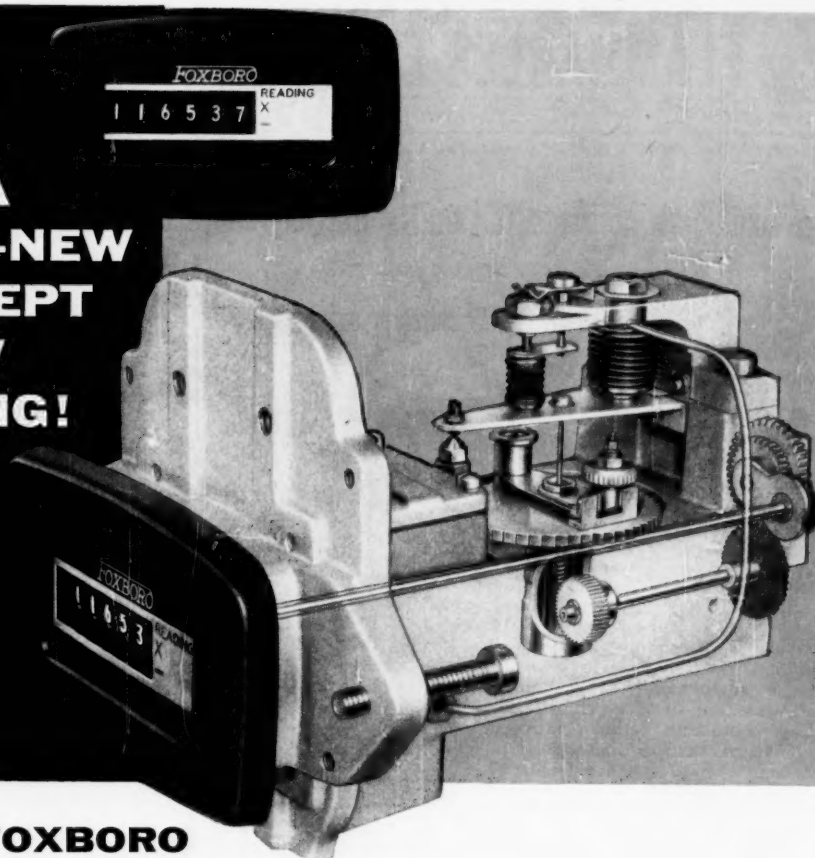
For up-to-the-minute information on vapor compression evaporation return coupon today.



Builders of equipment for the generation and utilization of heat

NOW!

A BRAND-NEW CONCEPT IN FLOW TOTALIZING!



... THE NEW FOXBORO PNEUMATIC **FLYBALL** INTEGRATOR

Inherently Accurate!

- Eliminates Inaccurate "Spot Check" Counting!
Continuous integration assures highest precision.
- Eliminates Cam and Linkage Errors!
Unique design balances differential pressure signal directly against centrifugal force.
- Eliminates Calculations!
Automatically extracts square root — shows totals in desired units.
- Eliminates Fire and Explosion Hazards!
Simple, all-pneumatic operation requires no electric motors, wires, or contacts.

FOXBORO

REG. U.S. PAT. OFF.

Now you can integrate the flow of all process fluids or plant services continuously . . . with new accuracy . . . complete safety! The all-pneumatic Foxboro Flyball Integrator completely eliminates intermittent counting and fire hazard. Its simple, force-balance operation utilizes the 3-15 psi air signal from any conventional differential-pressure flow transmitter. This signal is continuously balanced against the "flyball" force of the instrument's pneumatically-driven turbine. The square root function is automatically extracted . . . you read flow totals directly.

The Flyball Integrator mounts at the point of measurement or on a panel hundreds of feet away. Response and accuracy are completely unaffected by ambient temperature changes or pressure changes in turbine air supply. Ideal solution to all plant fluids accounting and in-process inventory checking. Write for complete details. The Foxboro Company, 361 Neponset Ave., Foxboro, Mass.

FIRST IN FLOW



FLAMMABLES ENGINEERING BY PROTECTOSEAL

FLAMMABLES CONTROL METHODS AND PRACTICES IN PRODUCTION, PROCESSING AND IN MAINTENANCE

PUBLISHED BY THE PROTECTOSEAL COMPANY, CHICAGO, ILLINOIS

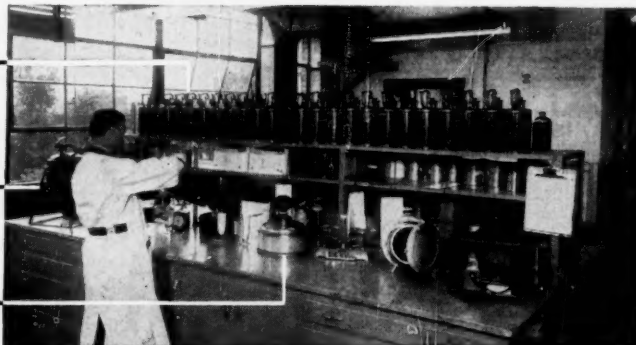
WAREHOUSES: CAMDEN, N. J.; LOS ANGELES, CALIF.

Fire-explosion controls for the industrial laboratory

Space-saving shelf storage. Convenient, oval shape containers now safely store more liquids in limited shelf area.

Fire-safe accurate dispensing. Full pouring control avoids hazard of spillage. No lifting of heavy, awkward unsafe cans.

Fast, controlled waste disposal. Provides fire-safe disposal and removal of waste liquids from laboratory work stations.



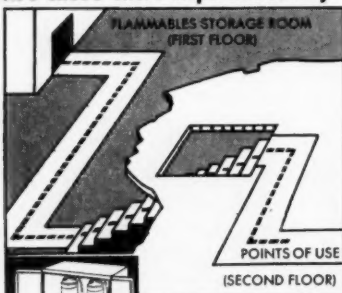
Specially designed safety containers eliminate constant hazard of awkward, hard-to-handle, leaky, make-shift cans and bottles. Oval shape safety containers require far less shelf space than ordinary unpro-

tested round cans . . . easily labeled for quick identification. Safety dispensing container on tilt-frame has special fire-protective top faucet . . . provides visual, controlled transfer of liquids to smaller laboratory con-

tainers . . . simply tilt and pour. Wide-mouth chemicals disposal can safely provides for elimination of waste chemicals . . . does away with hazardous practice of pouring chemicals into sink drain.

For Further Information Request Laboratory Safety Equipment File No. 67

Are these extra trips necessary?



No! . . . time-saving flammable liquids storage cabinet may be located close to work station . . . within the plant or laboratory . . . permits convenient storage of up to 45 gallons of flammable liquids at-the-job . . . stops wasteful, time-consuming trips to remote storage vaults. Built to N.F.P.A. specifications.

For Further Information
Request Flammables Storage Cabinet File No. 55

Reduce corrosion losses in flammables handling equipment

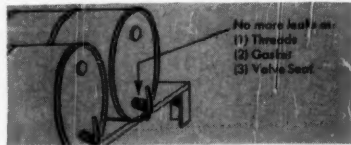
Certain liquids used in chemical industries found to corrode standardterne plate storage-dispensing containers . . . cause contamination of contents . . . weakening of body seams. Tests show special metals,

such as stainless steel, often best suited for these liquids . . . other types may require monel metal or hot tin dipped coatings. Protectoseal engineers design and build custom special-purpose equipment to meet individual requirements.

For Further Information
Request Special Metal Containers File No. 74

Saves costly drum faucet repairs—replacements

Stainless steel construction eliminates corrosive action and contamination of liquids. No leakage! . . . self-positioning spout on swivel avoids



stripped threads . . . Teflon O-Ring Gasket universally impervious to all liquids . . . no wrench-pressure damage to valve seat located at inlet end of faucet. Result—flammables . . . and corrosives . . . dispensed safely . . . fewer faucet repairs . . . far longer faucet life.

For Further Information
Request Drum Dispensing File No. 68

Plant waste disposal hazards can be avoided

Good housekeeping begins at the job . . . with safety waste disposal cans lo-

cated at each work station . . . prevents hazardous pyramiding of wastes within the plant . . . avoids possibility of overloading wastes in one area with the hazard of spontaneous combustion fires . . . keeps plant and lab premises safe, orderly.

For Further Information
Request Safety Waste Containers File No. 57

How to avoid excessive corrosion losses on tank safety vents

Secure individual types of corrosion-resistant metals for valves, flame arresters, housings. Precision engineered vent designs are available in wide choice of special metals . . . insure longer working life . . . fewer inspections . . . less parts replacement. Combinations of metals to meet individual problems of corrosive vapors and atmospheric conditions include the following:

Aluminum	Stainless Steel	Brass
Cast Iron	Bronze	Monel
		Hastelloy

AT YOUR SERVICE...

Specialized experience in flammables engineering from Protectoseal Field Engineering Service. Provides practical ideas and safe, cost-saving hints on storage, handling and use.

C. R. "Connie" Seim
serving the Pacific Coast states.



THE PROTECTOSEAL COMPANY

1948 So. Western Ave., Chicago 8, Illinois
In Canada: Safety Supply Co., Toronto

New Dimension for Product Control...



TWINS do the Pumping

in New Gaulin Twin-Lobe® Rotary Positive Displacement Pump*

Twin-Lobe is a radically different pump design that brings exceptional efficiency to positive displacement pumping.

Check these exclusive advantages...

- Simplified design and construction, only three moving parts.
- High efficiency. Size for size the Gaulin "Twin-Lobe" delivers larger volume, requires less horsepower, pumps higher volume at low speed.
- Smooth action, metering accuracy. Non-pulsating, non-foaming action, no agitation or churning.
- No gears or meshing teeth to chew or bruise foods, plastics or chemicals.

Ask for New Bulletin!

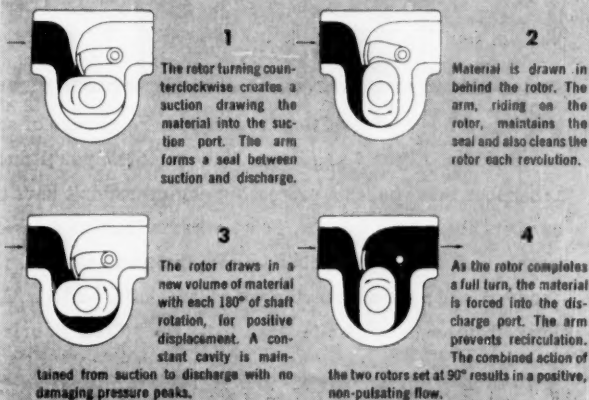
TLP-57 and GTA will help you put this pump to work — write or call, today.

*Pat. Applied For



How the "Twin-Lobe" design works

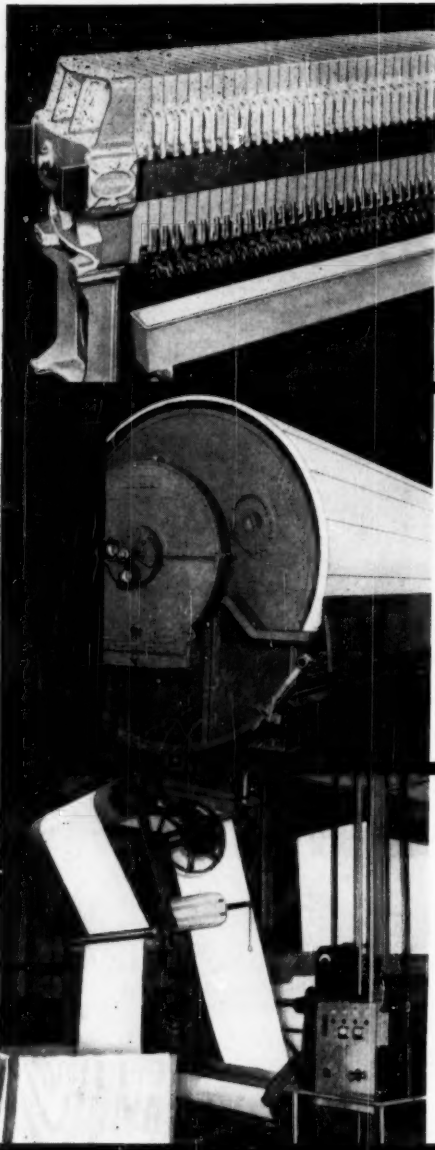
Note: For clarity, the pumping action of only one rotor is illustrated and described.



MANTON-GAULIN MANUFACTURING COMPANY
71 Garden Street, Everett 49, Mass.

World's largest manufacturers of stainless steel reciprocating, rotary, pressure exchange pumps, dispersers, homogenizers and colloid mills.

FILTER FABRIC QUIZ



1. Of course you recognize this as a recessed-plate pressure filter. In such filters, where intervening frames are not present, is it true or false that filter cloths must have exceptionally high flex and abrasion resistance?

2. A cotton filter fabric is at work. Which of these is *not* characteristic of untreated cotton fabric: (a) very high wet strength; (b) surface slickness; (c) natural twist for spinning strong yarns.

3. Can you tell what's going on here in the textile finishing plant? Hints: the fabric is nylon, and the process is concerned with dimensional stability.

Here are a few more questions to test your knowledge of some basic filter fabric facts. Even if you score 100, we think you'll find it helpful to remember that you, as a processing engineer, don't have to know all the answers about filter fabrics. That's what we're here for. Wellington Sears people and the filter specialists who distribute our fabrics are always ready to lend a hand in solving your filter cloth problems. And for a handy book of information, write Dept. L-1-8 for "Filter Fabric Facts."

For answers, turn page upside down

3. heat setting

2. (b)
1. true

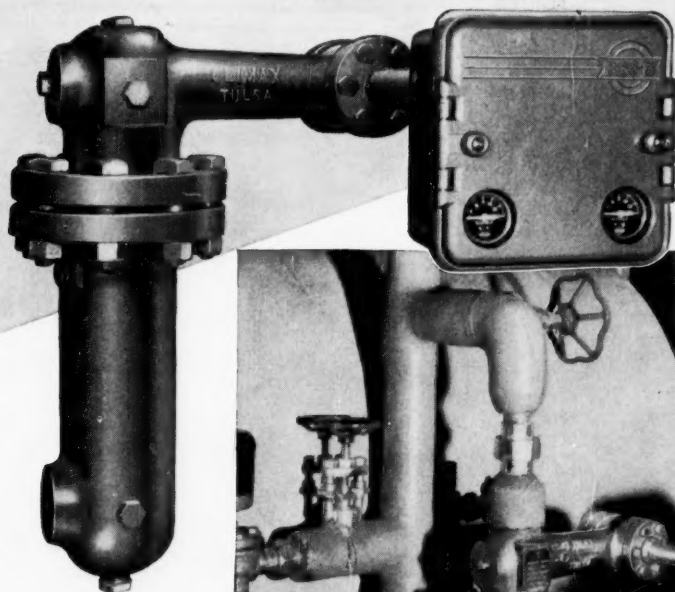


WELLINGTON SEARS

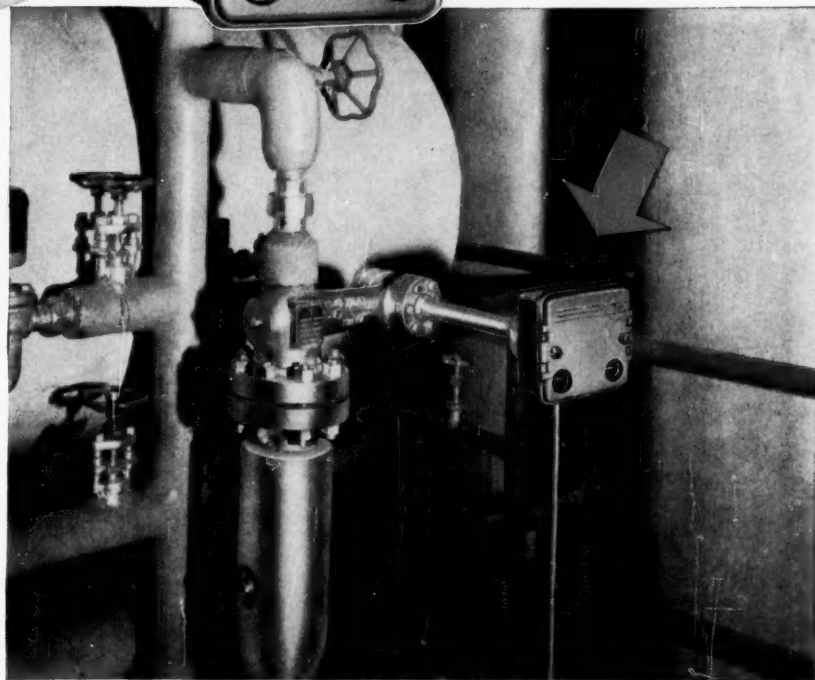
FIRST In Fabrics For Industry

Wellington Sears Co., 65 Worth St., N. Y. 13, N. Y. Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

When An External Cage Type Liquid Level Controller Is Indicated, Specify The . . .



**BS&B
Type 71-06,
Series 2!**



1. **"Built In" Accuracy:** Engineered to control within close level tolerances.
2. **Rugged:** Capable of continuous operation under severe service conditions.
3. **Versatile:** May be either transmitter or controller. Set for differential-gap, on-off, or proportional control. Controller output range in 3-15, 3-27 and 6-30 psig.
4. **Time Proven:** Utilized on heat exchangers, reboilers, deaerators, condenser hotwells and other similar applications in plants the world over.

For Complete Information On The
BS&B Type 71-06, Series 2, Or
Other BS&B Liquid Level Con-
trollers, Contact Your BS&B Sales
Engineer — or Write To . . .

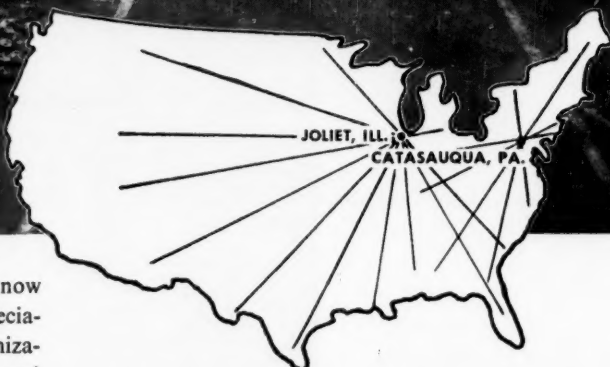
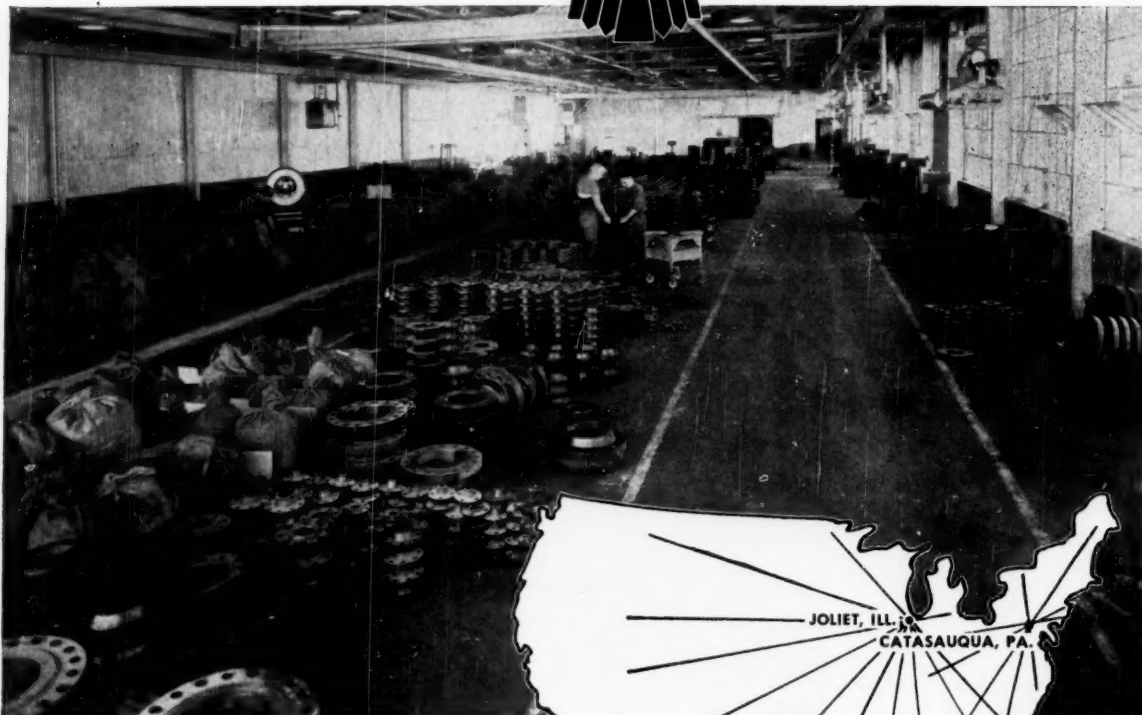
BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-NI

7500 East 12th Street

Kansas City 26, Missouri

Why Service On **PHOENIX FLANGES** Is So Good!



When you place your order with Phoenix you know that you *can't buy a better flange*. A sincere appreciation for your order is felt throughout our organization. To expedite your orders we have expanded and streamlined our warehouse facilities, as shown, to make Phoenix service even better. For your regular requirements or special flanges in carbon or alloy steel, contact Phoenix and we'll show you what we mean.

Write for handy 36 page pocket-size reference booklet containing useful data on flanges.



IMMEDIATE SHIPMENT FROM TWO FACTORY WAREHOUSES

Conveniently located in the East near Philadelphia and Metropolitan New York and in the Midwest near Chicago, Phoenix factory warehouses at Catasauqua, Pa. and Joliet, Ill. are prepared to ship immediately regular types and sizes of quality Phoenix forged steel pipe flanges. That's why prompt delivery is assured—overnight to nearby points—in only a few days to distant points.

Leading Manufacturers of Pipe and Tank Flanges and Commercial Forgings



FLANGE AND FORGING DIVISION

PHOENIX MANUFACTURING COMPANY

CATASAUQUA, PA. • JOLIET, ILL. • FOUNDED 1882

Integrated Manufacturing Facilities: FLANGE AND FORGING DIVISION, STEEL MILL DIVISION, HORSESHOE PRODUCTS DIVISION, RUBBER PRODUCTS DIVISION

**THE NAME THAT
PROVES**

Quality=Economy

Pumps that bear the name Wilfley are money savers. Production records consistently prove that Wilfley quality pays off in lower pumping costs. Rugged, heavy-duty construction provides long, trouble-free service on tough as well as easy pumping jobs. Let a Wilfley Acid Pump go to work for you . . . it starts saving money the moment it goes into action. Available with pumping parts of the machinable alloys as well as plastic to meet all requirements.

WILFLEY
ACID PUMPS

Wilfley Sand Pumps
"Companions in Economical Operation"
Wilfley Acid Pumps

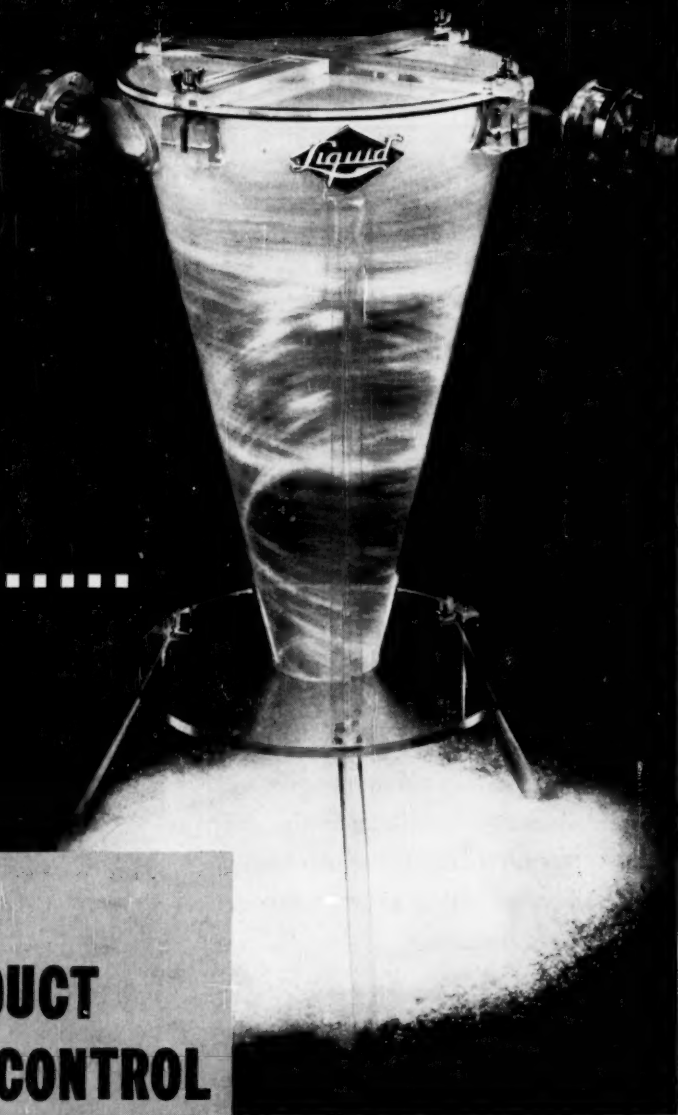
Write, wire or phone for complete details.

A. R. Wilfley and Sons, Inc.

DENVER, COLORADO, U. S. A.

NEW YORK OFFICE: 122 EAST 42ND STREET, NEW YORK CITY 17

SNOW JOB.....



By Snow Generator or By Direct Injection,
The Liquiflow CO₂ System Insures

ABSOLUTE PRODUCT TEMPERATURE CONTROL IN PULVERIZATION

- Assures the uniform refrigeration required in size reduction on chemicals, resins, plastics, pharmaceutical products, antibiotics, sugar, spices and heat sensitive products.
- Effectively inerts flammable materials during milling by lowering the oxygen concentration.
- Milling capacity is greatly increased by use of Liquiflow (liquid CO₂ system).

HOW WILL CO₂ HELP YOU MOST?

Write for free booklet "Applications Unlimited" which describes pulverization and dozens of other uses for CO₂. We will also send complete information on the Liquiflow system.

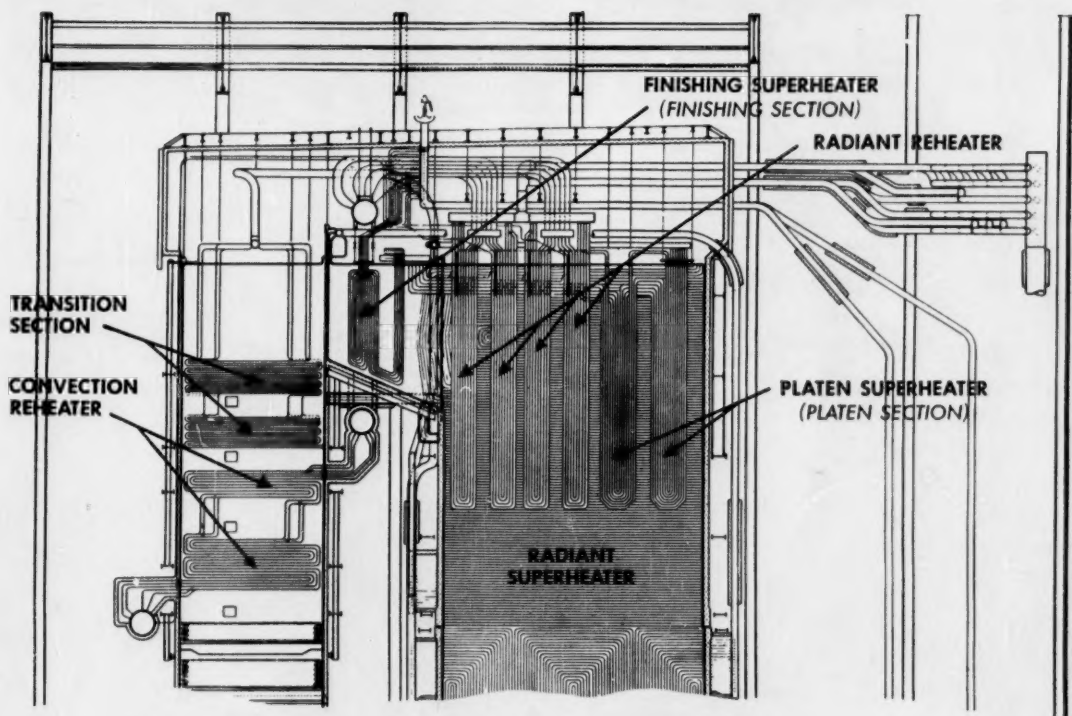
World's Largest Producer of

**LIQUID
CARBONIC**

DIVISION OF GENERAL DYNAMICS CORPORATION

3118 S. Kedzie Avenue
Chicago 23, Illinois





Philadelphia Electric sets new record for steam pressure-temperature using *Timken® seamless steel tubes*

COMBUSTION ENGINEERING CO., had the job of designing and building a steam generator for a revolutionary new power plant for Philadelphia Electric. They had to harness the highest combination of pressure-temperature ever achieved with steam—5,000 psi and 1,200° F.

This meant superheater tubes made of a special, stronger steel never before used in steam power plants. But no one had ever succeeded in piercing this tougher steel. Combustion Engineering gave the problem to Timken Company metallurgists, experts at piercing special steels for 29 years. And they turned the trick. They made the electric furnace steel with the alloying elements in just the right balance to develop perfect piercing quality. They were able to pierce 20 miles of tubes free from either surface or internal flaws.

And now you can get Timken® heavy wall seamless tubes up to 11" O.D. x 3/4" wall. It's available in all the popular low and intermediate alloy steels and austenitic stainless grades—304, 316, 321, 347 and other special analyses. This gives designers a broad range of high temperature strength together with the required degree of corrosion and oxidation resistance. And delivery is within normal mill lead times.

Because we make our own electric furnace Timken fine alloy steel, you can be sure of accurate analysis—uniform from heat to heat, order to order, tube to tube. If you have a tubing problem, Timken Company metallurgists will gladly help you solve it. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

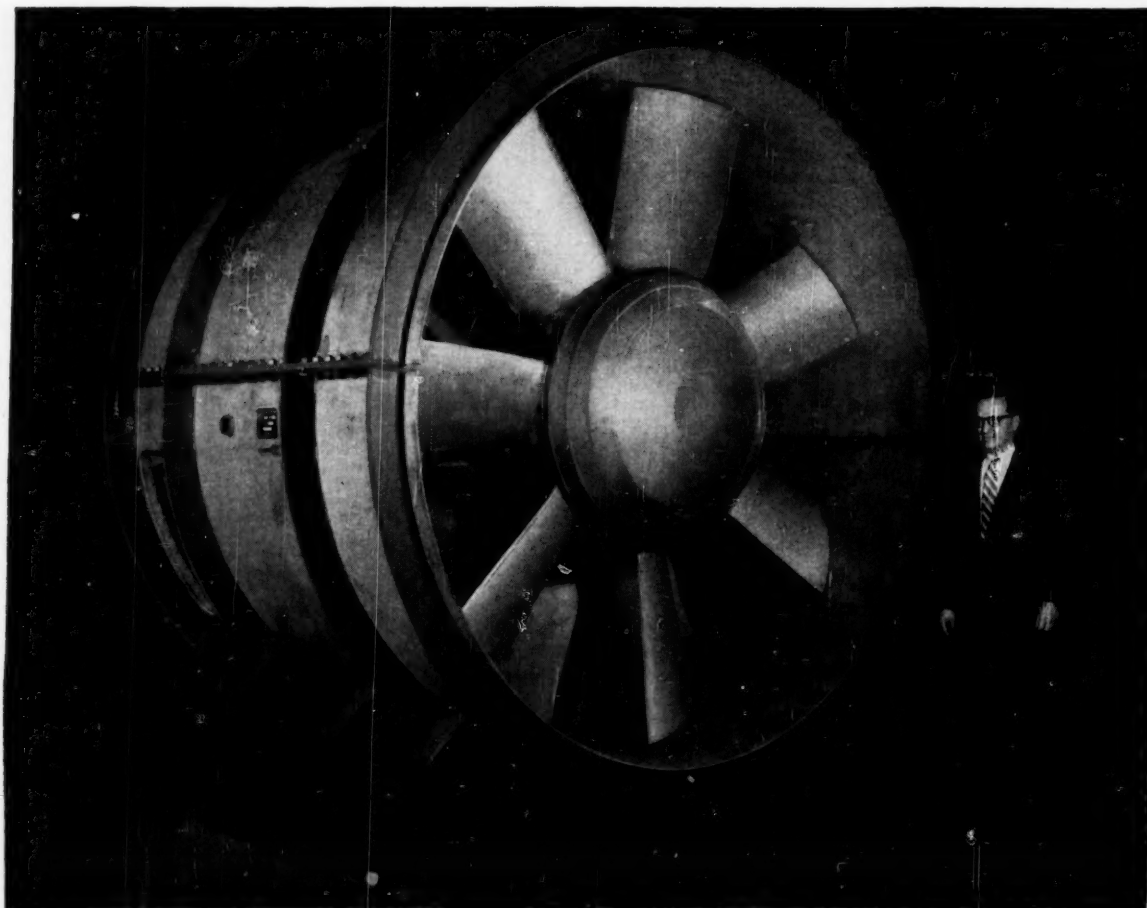
TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

CHEMICAL ENGINEERING—January 13, 1958

51



WHERE AIR MOVING REQUIRES AXIAL FLOW FANS, "BUFFALO" AXIALS HAVE MOST TO OFFER

Big jobs, like the one shown above . . . or smaller jobs, like the hood exhaust at lower left . . . "Buffalo" Axial Flow Fans take them all in stride.

The demand for "Buffalo" Axials is steadily increasing, because they offer so many superior advantages. Among these are extremely high efficiencies, quiet operation, built-in rigidity of construction and compact size. Ideal for straight-line duct connections, "Buffalo" Vaneaxial Fans eliminate the swirling motion of air by means of scientifically-engineered guide vanes. This energy is thus converted into useful forward thrust.

"Buffalo" Axial Flow Fans are the perfect solution to many plant space problems. Duct-size, they hug walls and ceilings, conserve productive space. They are doing an outstanding job in space-saving applications throughout industry, ranging from exhaust and ventilation to industrial air conditioning.

If your installation calls for axial flow fans, be sure they're "Buffalo" Axials. Contact your nearest "Buffalo" Engineering Representative, or write us today for Bulletin 3533-EF.

An important feature of *all* "Buffalo" Fans is the "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



HOOD EXHAUST — Right in the Stack. Duct-size "Buffalo" Axial Flow Fans are economical to install — singly or in multiple — for in-stack exhaust applications utilizing a weather-protective hood. Installations such as this are popular in plants . . . wherever space is at a premium.

BUFFALO FORGE COMPANY

Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT
EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

U.S.I. CHEMICAL NEWS

January

★

A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries

★

1958

New Non-Narcotic Drug Has Potency of Codeine

A new analgesic drug—dextro propoxyphene—is now on the market. It is reported to be clinically equivalent to codeine in intensity of analgesia, and in onset and duration of action. At the same time, side effects are said to be fewer. No toxic effects on liver, blood, brain, kidneys or other organs have been demonstrated. And, after several years of exhaustive tests, government authorities have classified the material as non-narcotic drug—producing no euphoria, tolerance or physical dependence.

Dextro propoxyphene hydrochloride also acts as an antipyretic, reducing fever, and as an anti-inflammatory, combatting local hyperemia and swelling. Clinical usefulness is expanded by combining this amino ester with other ingredients such as acetophenetidin, caffeine and acetylsalicylic acid.

Although chemically different from all other analgesics, it is believed to act in the same manner as meperidine, codeine and morphine—that is, by raising the pain perception threshold through depression of the sensory area of the brain.

Riboflavin Overcomes Boron's Growth Inhibition

A European microbiologist has found that riboflavin overcomes the growth inhibition of test organisms caused by boron. None of the other B vitamins have this effect.

These findings may have some importance in areas such as the American southwest where the soil has a high boron content. Boron is taken from the soil by plants which are consumed by livestock, and the element may tend to interfere with the vitamin metabolism of these animals.

Viscosity Changes May Be Clue to Chemical Activity In Complete Ester Mixtures

Investigations reported in the literature have revealed that the viscosity of true ester mixtures of ethyl alcohol, acetic acid, ethyl acetate and water changes steadily on standing. The conclusion is that association, dissociation, hydrate and solvate formation are taking place, and that viscosity determinations may therefore be useful in studying the progress of such activity.

Viscosity has long been employed to determine the extent of molecular association, and the degree of solvate and hydrate formation in liquid mixtures at some particular moment. It has never been used, however, to examine changes over time intervals.

In the study reported, relative viscosity measurements were made on complete ester mixtures after 2, 9, 21, 51, and 84 days. Viscosities changed steadily, but tended to reach an equilibrium value. The investigators feel that this time factor must be properly evaluated before further study of hydrates, solvates and association values is made.

Sorbitol Solubility Measured In Elixirs and Syrups Containing Alcohol and Water

Studies Reveal Solubility of Sorbitol in Water-Ethanol Mixes

The hexahydric alcohol, sorbitol, widely used in liquid pharmaceutical preparations, has now been thoroughly studied in water-ethyl alcohol systems to determine extent of solubility. The table and phase diagram below show the

results of this investigation. They indicate that a sizable amount of sorbitol can be incorporated into most pharmaceutical systems of hydroalcoholic character—about 65% by weight in 20% alcohol, about 50% by weight in 50% alcohol, about 14% by weight in 80% alcohol, and so on.

Polyethylene Use Is Extended by New Compounding Process

A process, whereby polyethylene is combined with 50% or more of carbon black to create compositions which remain flexible even at extremely low temperatures, has been developed by Godfrey L. Cabot, Inc.

These compositions are said to be strong enough for structural use where rigidity and pressure resistance are important. Creep and fracture are reported to be minimum.

A variety of molded and extruded parts have been fabricated successfully from the new material. Pipe, for example, has exhibited resistance to stress cracking, improved high temperature behavior, virtual elimination of plastic flow, and improved resistance to deterioration by solvents and oils. Lab tests have indicated that burst strength is doubled. The same applies to wire and cable cover.

Cabot feels that the development makes possible a new range of usefulness for polyethylene. They will not manufacture these compositions themselves but will supply the carbon black and their process knowledge to polyethylene producers such as U.S.I.

New Ceramic Textiles Withstand Heat of 2000°F

Aluminum silicate fibers have now been converted into a variety of textile forms for high temperature applications.

Fabrics weighing from 15 to 74 ounces per square yard are said to have excellent insulating properties due to low thermal conductivity, high yarn bulk, natural resilience and small fiber diameter. Stainless steel or nickel-chrome alloy wire is inserted into some constructions for greater tensile strength in the 1,000 to 2,000°F range.

Rovings and yarns in sizes from 600 to 1,000 yards per pound are useful as insulation for electric circuits that must withstand very high temperatures.

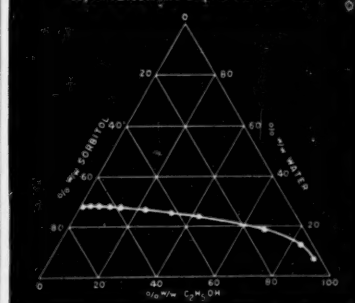
Rope from 1/4 to 3/4 inch in diameter is being applied as insulation and packing in various metallurgical refining processes.

Other suggested uses for cloth and tape include filter media, gaskets, heat and flame barriers and membranes, conveyor belts, protective clothing and insulating blankets.

SOLUBILITY OF SORBITOL IN
HYDROALCOHOLIC LIQUIDS AT 25°C.

Sample	C ₂ H ₅ OH	Sp. Gr.	% v/v Saturated Solution	% w/w Sorbitol	% w/w Sorbitol
1	0	1.308		71.90	94.05
2	11.33	1.284		68.62	88.22
3	20.73	1.265		66.02	83.50
4	33.86	1.233		62.38	76.92
5	41.47	1.200		57.98	69.59
6	52.80	1.152		50.45	58.12
7	62.33	1.089		42.70	46.49
8	71.56	1.026		33.84	34.72
9	82.20	0.9123		13.64	12.42
10	90.94	0.8433		3.41	2.88
11	95.41	0.8177		1.92	1.57

Phase Diagram of Sorbitol Solubility in
Hydroalcoholic Liquids at 25°C.



It has been well known for some time that while sorbitol is highly soluble in water alone, the solubility tends to decrease when ethyl alcohol is added. Since sorbitol acts as a vehicle in many cough syrups, elixirs and vitamin preparations which contain alcohol, the extent of this decrease has become a question of great interest to the industry. Until this study was made, no data on the subject had been available.

Properties which have made sorbitol useful to the food and drug industries include sweet

MORE

January

★

U.S.I. CHEMICAL NEWS

★

1958

CONTINUED

Sorbitol

taste (about 60% as sweet as sucrose), high viscosity in water solution, lack of reaction with medicinal or other ingredients, ability to inhibit crystallization, and humectant action. It is often used in combination with glycols, glycerin and sugar syrup as well as ethyl alcohol.

Paper Can Now Be Made From New Acrylic Fibers

A new type of paper has been developed which will be of special interest to the laminating industry and for electrical uses, chemical filtration, chromatography and many other applications.

It is made of a new acrylic fiber, is binder-free, and can be produced on conventional machinery. Production quantities are expected in the near future.

First Caustic Soda Plant Established in Ceylon

May Also Produce Bromine

The first caustic soda factory in Ceylon, built by a government-sponsored corporation, is expected to begin operations this month. It is equipped with 56 electrolytic diaphragm cells having a daily output capacity of five tons of caustic soda.

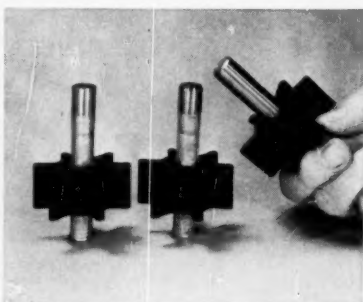
Bromine may also be produced. In the manufacture of common salt from sea water, a nearby factory discards thousands of tons of bromine-rich waste liquors. Engineers are considering the production of high-grade elemental bromine from these wastes.

Titanium Impeller Shaft Solves Corrosion Problem In Pumping Ferric Chloride

Impeller shafts of commercially pure titanium are now being used in pumps to carry ferric chloride solutions. They are reported to yield at least 320 hours of pump service without leakage. Materials tried previously—special ferrous and non-ferrous alloys, and platings of nickel, silver and rhodium—have given maximum service life of 45 minutes due to corrosion of the shaft and loss of tight seal.

The titanium impeller shaft was originally incorporated into a prototype pump unit and tested to solve a particular problem in the etching of printed circuits. It was found that the prototype unit would run for at least 321 hours without damage. And the initial cost of the special shaft was offset in the first 90 minutes of operation. The pump is now a regular production item.

Mallory-Sharon Titanium Corp., now affiliated with U.S.I. in the new Mallory-Sharon Metals Corp., participated in the original test runs by supplying the titanium.



At left are two impeller shafts which failed after 45 minutes of pumping ferrous chloride. Both are made of premium metals, one ferrous, one non-ferrous. At right is a titanium impeller shaft showing no sign of corrosion after two months in the same service.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

Research reactors now in operation or being built in the U.S. are reviewed in a new booklet which can be purchased from gov't. Data and illustrations on over 30 reactors are included. **No. 1311**

A marking pen consisting of a heavy-wall polyethylene squeeze tube with felt writing point, filled with ink that writes on porous and non-porous surfaces, is now on the market. It is low-cost, disposable, comes in 7 colors. **No. 1312**

New fuel oil additives to prohibit gum formation in oil stocks are fatty amine derivatives claimed to also protect against color degradation and to improve filterability. **No. 1313**

Over 1,500 assayed biochemical compounds, along with their full specifications, are listed in a new reference guide for workers in bacteriological, nutritional, biological and microbiological research. Price list included. **No. 1314**

Three new hydrazine derivatives are available in lab quantities. Hydrazine dihydrochloride is suggested as a chlorine scavenger for hydrochloric acid, hydrazodicarbonamide as a chemical intermediate, monohydrazinium phosphate as an oxygen scavenger for boiler feed water. **No. 1315**

Analytical microscopy relative to foods, drugs, spices, water is discussed in a new book which can be purchased. The 215-page book describes preparation of materials for examination, gives examples of problem solutions. **No. 1316**

Isocinchomeronic acid, suggested intermediate for drugs, insecticides, polymers, dyes, is now offered commercially. Its ring-nitrogen is said to offer possible increased dye receptivity in polymer applications. **No. 1317**

Remote evaporation and drying by infrared radiation is now possible with a new heater for lab and semi-industrial use. Placed above a flat crucible, the radiator is claimed to evaporate without boiling or loss of material. **No. 1318**

New acid inhibitor has been developed which, it is said, can be used on high carbon steel without etching. It is used at about 0.2% by volume, added to non-oxidizing acids such as sulfuric, hydrochloric, hydrofluoric, oxalic. **No. 1319**

Molded polyethylene waste and drainage systems are now on the market. According to the manufacturer, traps, pipe, joints, fittings will withstand intermittent flushing with boiling water without deterioration or loss of form. **No. 1320**

PRODUCTS OF U.S.I.

ALCOHOLS

Ethyl Alcohol (Ethanol): Specially denatured—all regular and anhydrous formulas. Completely denatured—All regular formulas for industrial use, anti-freeze. Pure alcohol—USP 190°—Absolute, N.F., taxfree, taxpaid.

Butanol (Normal Butyl Alcohol): Latent solvent for nitrocellulose, solvent for ethyl cellulose, many resins, many syntheses.

Amyl Alcohol, Refined: Fine chemicals, pharmaceuticals.

Fusel Oil, Refined: Blend of amyl alcohols refined by chemical treatment, distillation.

Proprietary Denatured Alcohol Solvents: SOLOX®—General-purpose. FILMEX®—Special, authorized for certain industries. ANSOL® M—Anhydrous, special blend for lacquers, resins, etc. ANSOL® PR—Anhydrous, special blend with higher ester content and solvency for lacquers, resins, etc.

OTHER PRODUCTS

PETROTHENE® Polyethylene Resins

Inorganic Chemicals: Sodium, Chlorine, Caustic Soda, Sodium Peroxide, Sodium Sulfate, Sulfuric Acid, Phosphoric Fertilizer Solution (Wet Proc-

ess Phosphoric Acid) Ammonia, Nitrogen Fertilizer Solutions, Ammonium Nitrate, Zirconium Oxide, Zirconium Tetrachloride, Hafnium Oxide, Hafnium Tetrachloride.

Esters, Ethers and Ketones: Normal Butyl Acetate, Dibutyl Phthalate, Diethyl Carbonate, Diethyl Oxalate, Ethyl Acetate, Ethyl Ether, Acetone, Diethyl Ether.

Intermediates and Fine Chemicals: Acetoacetylides, Dimethyl Hydrazine, Ethyl Acetoacetate, Ethyl Benzoylacetate, Ethyl Chloroformate, Ethylene, Ethyl Chloride, Ethyl Sodium Oxalacetate, U.S.I. ISOSEBACIC® Acid, Methyl Hydrazine, Sodium Ethylate Solution, Triethyl Aluminum, Trimethyl Aluminum, Urethan USP (Ethyl Carbamate).

Animal Feed Products: Calcium Pantothenate, Choline Chloride Products, Curbay B-G® 80, Special Liquid Curbay®, DL-Methionine, Niacin USP, Riboflavin Concentrates, Vitamin B₁₂ and Antibiotic Feed Supplements, Vacatone® 40, Vitamin D₂, E and K₂ Products, Antioxidant (BHT) Products, U.S.I. Premadry Products (Sealed-in Vitamin A), Special Mixes, MOREA® Premix.

Pharmaceutical Products: DL-Methionine, N-Acetyl-DL-Methionine, Riboflavin USP, Urethan USP, Intermediates.

Metals: Titanium, Zirconium and Hafnium Sponge and Platelets, and Oxide.

U.S.I. SALES OFFICES

Atlanta • Baltimore • Boston • Buffalo • Chicago • Cincinnati
Cleveland • Dallas • Detroit • Houston • Indianapolis • Kansas City, Mo.
Los Angeles • Louisville • Minneapolis • Nashville • New Orleans
New York • Philadelphia • Pittsburgh • Portland, Ore. • St. Louis
Salt Lake City • San Francisco • Seattle

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.

Facts
about

STABILINE® Automatic Voltage Regulators



"Sunday Dinner's an Hour Late- and I'm Glad of it!"

"Guess everyone out our way turned on their electric ovens at once. Down went the voltage and dinner's delayed. But it made me wonder. What about under or overvoltage at the plant? Here are some facts I dug up:

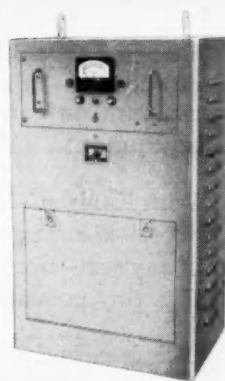
"TEN PERCENT UNDER VOLTAGE results in:

- ... 19% decrease in heat output of resistance heaters.
- ... 20% decrease in fluorescent lamp life and 15% decrease in light output.
- ... 19% decrease in starting and maximum running torque of induction motors.
- ... Drastic reduction in electronic tube life.
- ... Increase in rejects and process re-cycling due to sluggish solenoids and timers.

"Overvoltage can also increase operating costs in many ways.

"It's worth waiting an hour to be reminded that I can prevent these losses with a good automatic voltage regulator."

That's right, STABILINE is the automatic voltage regulator to use. It will make sure that your electrical equipment operates at its most efficient and economical rating — the rating for which it was designed.



STABILINE holds output voltage constant... and ends production troubles caused by voltage variations.

Be sure to see
SUPERIOR ELECTRIC'S
Mobile Display
when it is in your area



THE SUPERIOR ELECTRIC COMPANY
1401 BRADLEY AVENUE, BRISTOL, CONNECTICUT

Please send STABILINE Bulletin S657 ☐
Have your representative call ☐

Offices: Los Angeles, California • San Francisco, California • Toronto, Ontario, Canada • Miami, Florida • Chicago, Illinois • Baltimore, Maryland • Detroit, Michigan • New York, New York • Cleveland, Ohio • Dallas, Texas • Seattle, Washington

Name.....
Company.....
Address.....
City..... Zone..... State.....

WHEREVER
YOU
NEED
THE
PROTECTION
OF NICKEL
YOU
CAN USE
LOW-COST

KANIGEN®

Kanigen® nickel-alloy coatings provide corrosion resistance and product contamination protection to process equipment.

With Kanigen—a hard, uniform, chemically-deposited coating—you can protect equipment of any size—from the interior of a huge dryer to a tiny pressure-relief valve.

This inexpensive nickel-alloy coating will do almost anything that nickel will do. Kanigen

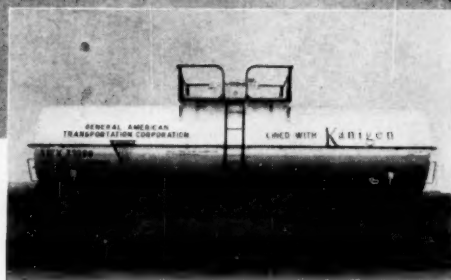
gives low-cost metals a hard, resistant nickel-alloy surface equal to or better than expensive alloys, solid metals or clad materials, at a fraction of the cost.

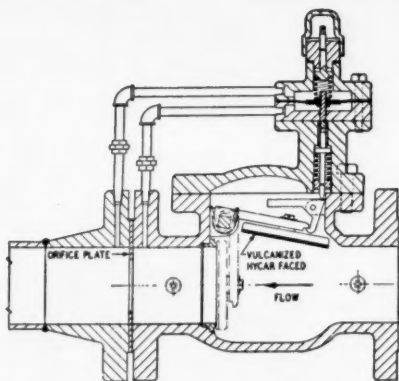
Your equipment or parts can be barrel-coated, rack-coated or jig-coated with Kanigen. General American has Kanigen plants at East Chicago, Indiana; Sharon, Pennsylvania, and Compton, California. Kanigen is also available from licensees in other parts of the country and abroad.



KANIGEN is a trademark which identifies chemical nickel coating by GENERAL AMERICAN TRANSPORTATION CORPORATION and its licensees, the product resulting therefrom and compositions produced by them for use in chemical nickel coatings.

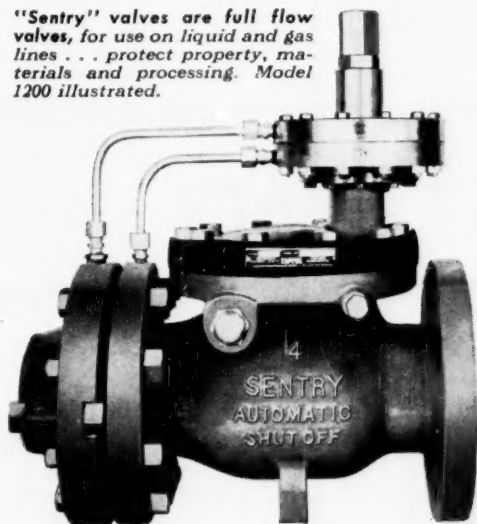
GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street • Chicago 90, Illinois



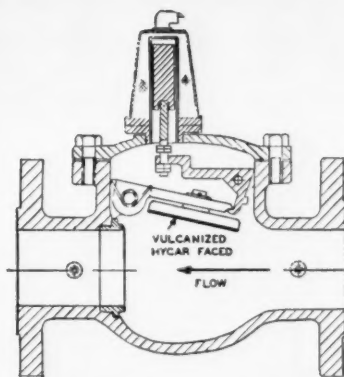


Model 1200. "Sentry" excess flow valve automatically and instantaneously shuts off when the rate of flow in the line exceeds a predetermined rate.

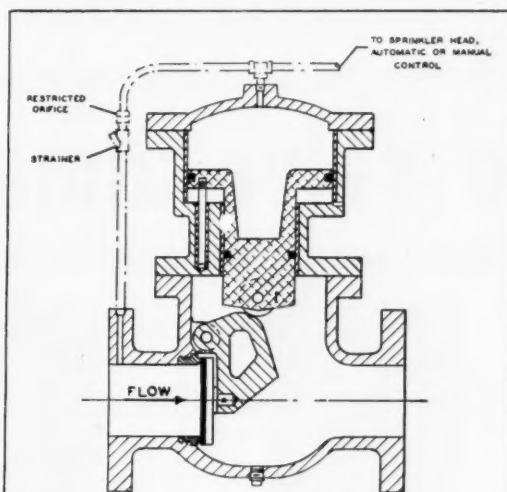
"Sentry" valves are full flow valves, for use on liquid and gas lines . . . protect property, materials and processing. Model 1200 illustrated.



Other types "Sentry" Valves: high-pressure and low-pressure and over temperature shut-off valves available.



Models 1700 and 1800 "Sentry" solenoid shut-off valves operate by remote electrical control automatically and instantaneously. In Model 1700, solenoid is energized, in Model 1800 solenoid is de-energized to maintain flow.



Model 3000 "Sentry" piston operated quick-opening valve opens instantaneously when the pressure above piston is released. Ideal for deluge systems — and for remote opening and closing of fuel line.

Now Coppus brings you "Sentry"® Valves for automatic protection

These valves are *patented* quick-closing latch type and quick-opening piston type. All are full flow valves.

Latch-type "Sentry" valves are widely used in the chemical, petroleum and gas industries for closing automatically and instantaneously gas, process and fuel lines. The piston type valve can be automatically or manually opened and closed

from any remote location. It is ideal for deluge systems, operates instantly; closing of this valve is against the flow, eliminating water hammer.

Sizes run from 1½" to a full 8". For full information send for Coppus Bulletin 500 to Coppus Engineering Corporation, 221 Park Avenue, Worcester 2, Massachusetts.



LOOK FOR THE BLUE BAND THAT IDENTIFIES COPPUS QUALITY

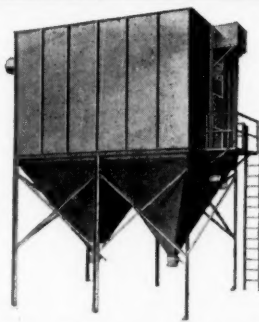
there is a Dracco unit



Whirl-Clones answer the need for efficient cyclone-type collection. Widely used with high temperatures, corrosive materials or large particle sizes, Dracco design assures efficient separation in units to 8-foot diameter. Welded construction assures minimum wear and long life.



Uni-Filters can be located at dust sources for efficient control with lower piping and power costs. Compact self-contained units with capacities from 300 to 1800 cfm require little space, are shipped ready to install and can be easily relocated.

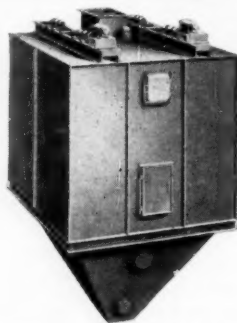


Multi-Bag Filters, basic Dracco unit, combine moderate cost with multi-duty versatility. Compact, space-saving housing can be installed inside or outside, contains unusually large cloth area. Models for intermittent or automatic, continuous service in wide size range with unsurpassed efficiencies.

to solve almost every



Dustomatic Filters are designed for continuous dust and fume recovery under heavy-duty conditions such as non-stop operation, high temperatures, heavy dust loads and high static pressures. Often used as integral part of chemical and metallurgical process equipment.



"DH" Filters are probably the finest units for automatic dust collection under severe conditions. Extremely rugged, they collect heavy, dense or sticky dusts that cannot be handled any other way. Well worth their extra cost because of their high capacity-to-size ratio.



"X" Filters, soon to be announced, will provide the long-sought answer to high-efficiency collection of hot or corrosive dusts and fumes. These advanced-design units are now being extensively field tested at temperatures to 600°F.

dust or fume problem

This extensive equipment line plus Dracco's 40-year reputation for solving the toughest dust problems are sound reasons for talking to Dracco first.

DRACCO CORPORATION • 4040 East 116th Street • Cleveland 5, Ohio

Complete 40-page catalog on Dracco Dust Control Equipment contains detailed data and valuable reference material. Write for Bulletin 800.

DRACCO *airstream conveyors*
dust control equipment

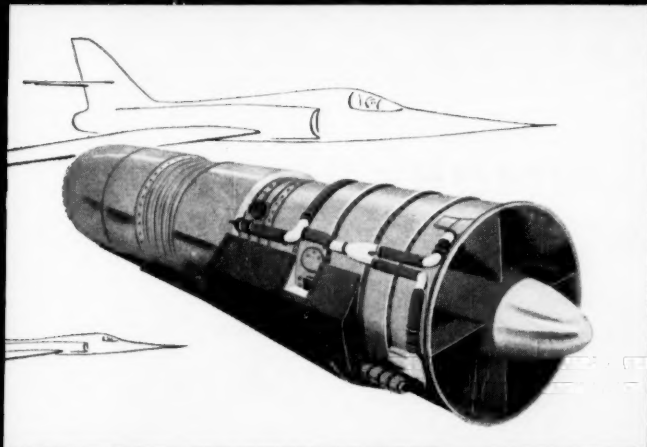
frequent **EQUIPMENT ADJUSTMENT** is a problem

that

Mallinckrodt[®]

uniformity has often solved

MALLINCKRODT PROCESS CHEMICALS MEET DIFFICULT SPECIFICATIONS FOR MANY INDUSTRIES



Misch Metal in alloys

Misch metal, an alloy of rare earth metals, provides magnesium casting alloys with qualities particularly applicable to jet engine parts. *Misch metal* decreases the porosity of the alloy, giving it pressure tightness, and increases its high-temperature creep resistance — the ability to withstand long periods of stress at high temperatures without distortion. The addition of *misch metal* to certain stainless steels improves their fabricating properties. Freedom from oxide coating is unique with Mallinckrodt *misch metal*. Technical information is available on request.

Your particular application of these and other Mallinckrodt industrial chemicals may be different. Drop us a note on your requirements —
you might be better served by Mallinckrodt.

Gallotannins for many uses

Tannic Acid is used in printing inks where it improves bleed-resistance, aids in pigment suspension, adds gloss and provides permanence. It serves as a coagulant and stabilizer in wine and other beverages. It is also used to coagulate aqueous suspensions of asbestos. *Gallic* and *pyrogalllic acids* are used in dressing and dyeing furs. The rubber industry has found *pyrogallol* helpful in vulcanizing synthetic rubber, inhibiting hardening and softening, and as a stopping agent in the copolymerization of GR-S rubber.

Mallinckrodt[®]

MALLINCKRODT CHEMICAL WORKS

SECOND & MALLINCKRODT STREETS, ST. LOUIS 7, MO. • 72 GOLD STREET, NEW YORK 8, N. Y.
CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • PHILADELPHIA • SAN FRANCISCO
IN CANADA: MALLINCKRODT CHEMICAL WORKS LIMITED • MONTREAL • TORONTO



The S.S. *Gulfbeaver*, first "jumboized" T-2, was converted by Bethlehem's Baltimore Yard in 36 days. "Jumboized," she has an overall length of 572 ft, beam of 75 ft and capacity of 20,168 dwt.

BETHLEHEM'S BALTIMORE YARD COMPLETES FIRST JUMBO T-2



Shifting of the 160-ton midships house from the old to the new and enlarged midbody was accomplished in 16 minutes through the use of an ingenious roller-bearing rail device



The new midbody was floated into dry dock for welding to the original stern, part of which can be seen in the foreground. In the background is the original midbody with bow still attached.



Following joining of the new and enlarged midbody to the stern, this unit was floated into another dock for welding to the original bow section which had been detached from the old midbody.

On April 2, 1957, the 20,168-dwt S.S. *Gulfbeaver*, formerly the 16,500-dwt *Gulfmeadows*, successfully completed her sea trials and became the first "jumboized" T-2 to get into operation.

Only 36 days earlier she had entered Bethlehem's Baltimore Repair Yard for the history-making job. The new midbody section was constructed by Bethlehem's Sparrows Point Yard and towed to Baltimore. Here the Bethlehem repair

yard, long a pioneer in complex conversions, tackled the "jumboizing" task and cleaned it up in five weeks.

With 48½ ft added to her length, 7 ft to her beam, approximately 3,500-dwt to her payload capacity and 12 to 15 years to her life, the *Gulfbeaver* is an example of Bethlehem's proven ability to handle all types of ship conversions and repairs with speed, economy and dependability.

NAVAL ARCHITECTS MARINE and NUCLEAR ENGINEERS

Unusual opportunities in many engineering categories are now available. Here's a once-in-a-lifetime chance to join the world's foremost shipbuilding organization. Address Dept. 272.

BETHLEHEM STEEL Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N. Y.

On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation

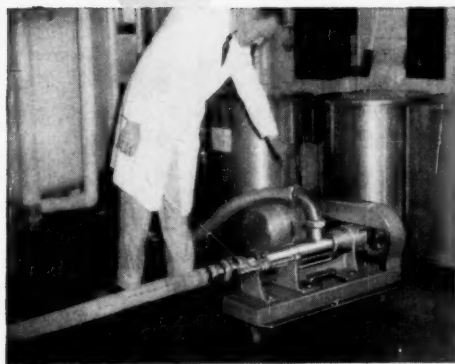


MOYNO[®] PUMPS

**CUT HANDLING COSTS
at Merck Sharp & Dohme,
Division of Merck & Co., Inc.**



...pumping mouthwash and general alkaline solutions



Moynos, with their "progressive cavity" pumping principle, provide a vital production lifeline at Merck Sharp & Dohme, Division of Merck & Co., Inc. They use Moynos to pump a variety of products, from water-like mouthwash to heavy pastes with viscosities up to 20,000 centipoise. The pump at the left, with a capacity of 30 GPM at 600 RPM, moves mouthwash and general alkaline solutions. Moynos have enabled thousands of plants to pipe different materials formerly moved by hand and other expensive means. They are the only pumps that will handle many difficult materials such as abrasives, pastes, slurries, chemicals, foods, suspended solids, etc., without foaming, aerating, crushing or excessive pump wear. Examine your processing methods. No doubt there are several places where Moyno Pumps can drastically cut costs. Ask us. We'll give you a prompt answer. Send us an outline of your problem today! Write for Bulletin 30-CB.



ROBBINS & MYERS, INC.

SPRINGFIELD, OHIO

BRANTFORD, ONTARIO



Motors



Fans



Hoists



Moyno Pumps



Propellair (Industrial) Fans

How to simplify control problems

Keep systems flexible, carry small inventory, cut maintenance cost with the **Bailey Building Block Method** of instrumentation and control.

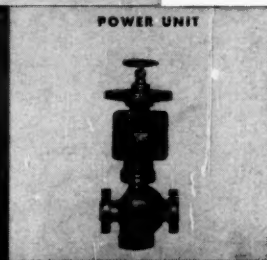
What is the Bailey Building Block Method? It's using standardized Bailey measuring, transmitting, and controlling components and combining them into any system you need. Components can be added as needed . . . removed and reused elsewhere . . . recombined into another system when the need changes. It's flexibility plus!

It's all based on the simple fact that a Bailey instrument or control component doesn't care if the measured variable is steam flow, tank level, or tower temperature, to pick just three examples. System components—transmitters, receivers, relays, selector stations, power units—are standardized for multi-purpose use.

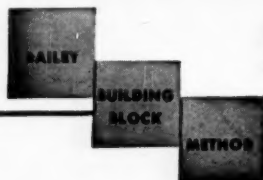
A spare component can be used in any one of many systems. Gone are delays waiting for shipments of special parts. Gone are large inventories of spares and parts. Simplified is the training of men for maintenance.

There are many exclusive features and advantages of the individual components used in the Bailey Building Block Method. And there's much more to the Building Block story itself.

For further details, call our local district office or write us at Cleveland. Our engineers will be glad to prove how the Building Block approach will save you money and simplify your instrument and control problems.



G36-1

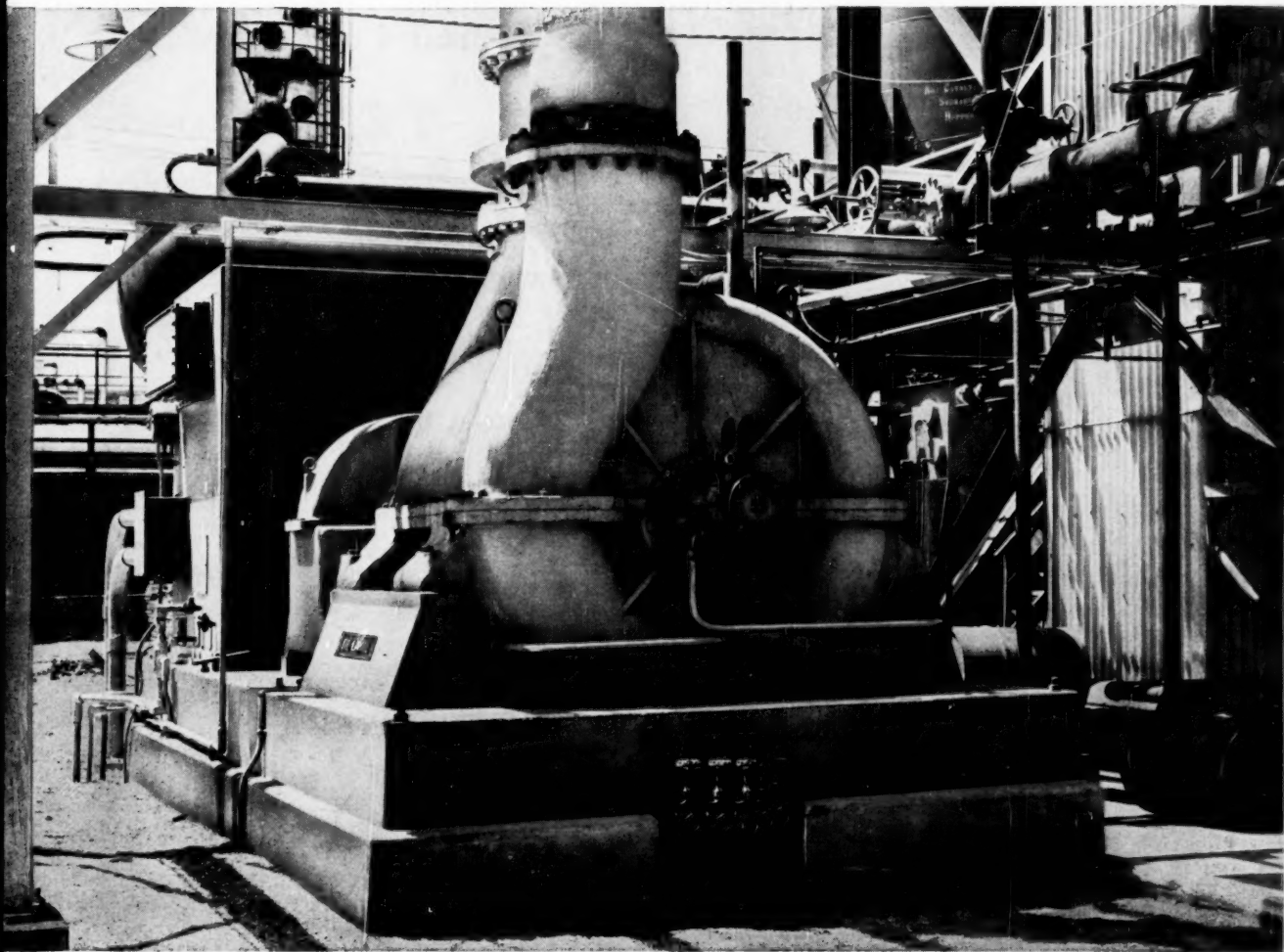


BAILEY METER COMPANY
1054 IVANHOE ROAD, CLEVELAND 10, OHIO
In Canada — Bailey Meter Company Limited, Montreal

RESULTS IN: FLEXIBILITY, SIMPLICITY, ECONOMY



Another **DE LAVAL** *combustion air compressor*
dependably serves refinery cat cracker



On stream at the Coffeyville, Kansas plant of the Cooperative Refinery Association, this De Laval Centrifugal Compressor delivers 24,100 cfm of air. Inlet pressure is 14.0 psia, discharge pressure 38.9 psia. Compressor output is controlled with adjustable inlet guide vanes.

This De Laval main air compressor is driven by a 2500 hp, 1800 rpm motor. Shaft speed is increased to 4800 rpm through a De Laval double helical speed increasing gear.

Cooperative Refinery Association is only one of many refiners who have specified De Laval Compressors. Whether you need to handle light or heavy gases at high or low pressures in catalytic cracking, reforming, alkylation, coking or any similar service, it pays to look to De Laval. Rugged De Laval centrifugal compressors perform dependably in heavy-duty continuous operation. De Laval has more than 40 years of experience in solving gas compression problems.



DE LAVAL *Centrifugal Compressors*

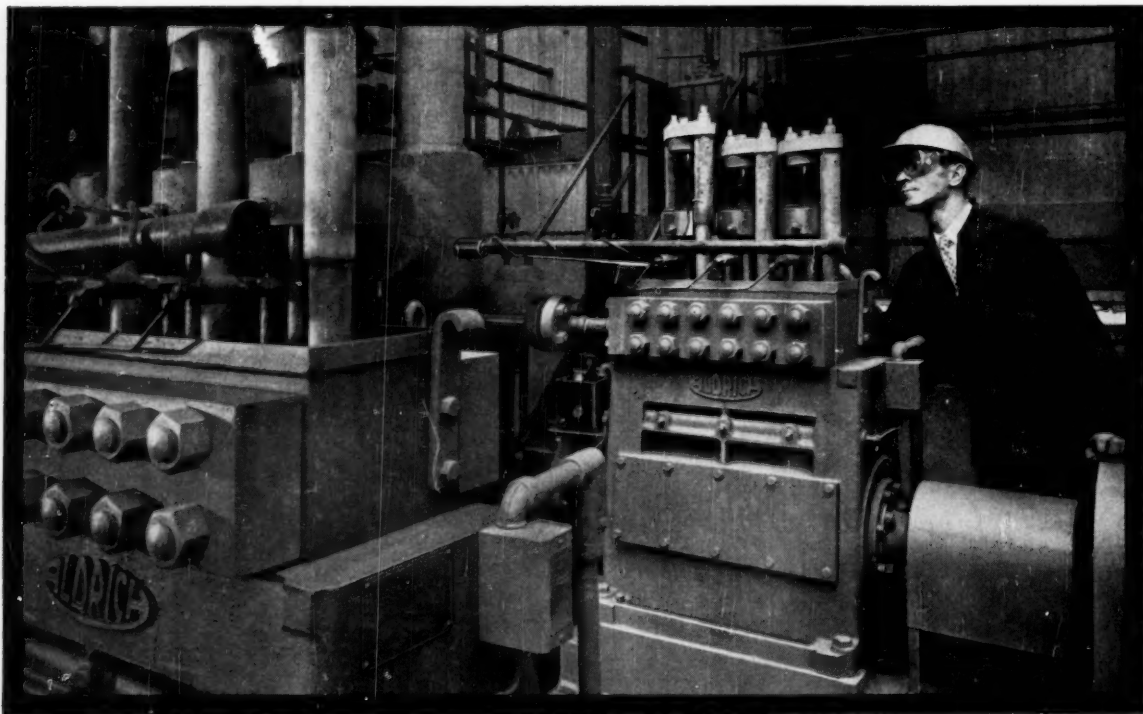
DE LAVAL STEAM TURBINE COMPANY
803 Nottingham Way, Trenton 2, New Jersey

DL 389

SPENCER CHEMICAL CO. UNRAVELS KNOTTY PROBLEM:

Maintaining a controlled flow of liquid ammonia at high pressures, 24 hours a day.

At the Vicksburg, Miss. plant of Spencer Chemical Company, ammonia production demands two things of pumps: (1) 24-hour, 7-day-week operation and (2) continuous flow of controlled volumes of liquid ammonia at high pressure.



How Spencer licked the problem: When Spencer began outlining construction plans in 1951, company engineers specified two Aldrich Direct Flow, $\frac{3}{4}$ " x 3" stroke Triplex Pumps. These were scheduled to be used for alternate 30-day periods. According to company spokesmen, nearly four years of service have proved these pumps to be efficient and capable of durable service.

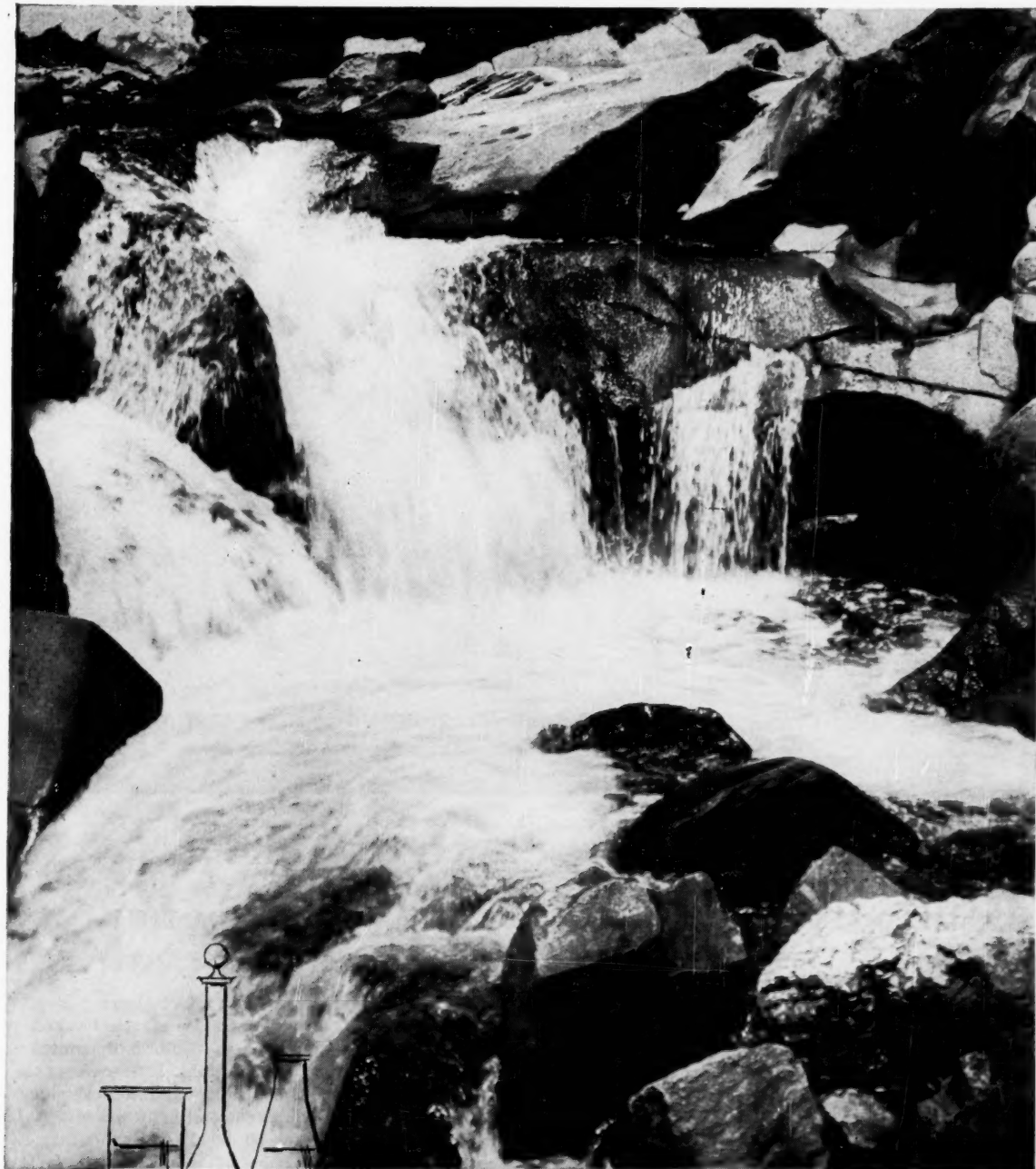
Results: Dependability and freedom from

trouble in all phases of operation. The Vicksburg Works Maintenance Superintendent tells us: "The Aldrich Pump is an excellent unit. Valve life is excellent and packing life exceptionally good."

We'll be glad to send you full information on Aldrich Pumps and their advantages to you. Simply write Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

the toughest pumping problems go to





Purity

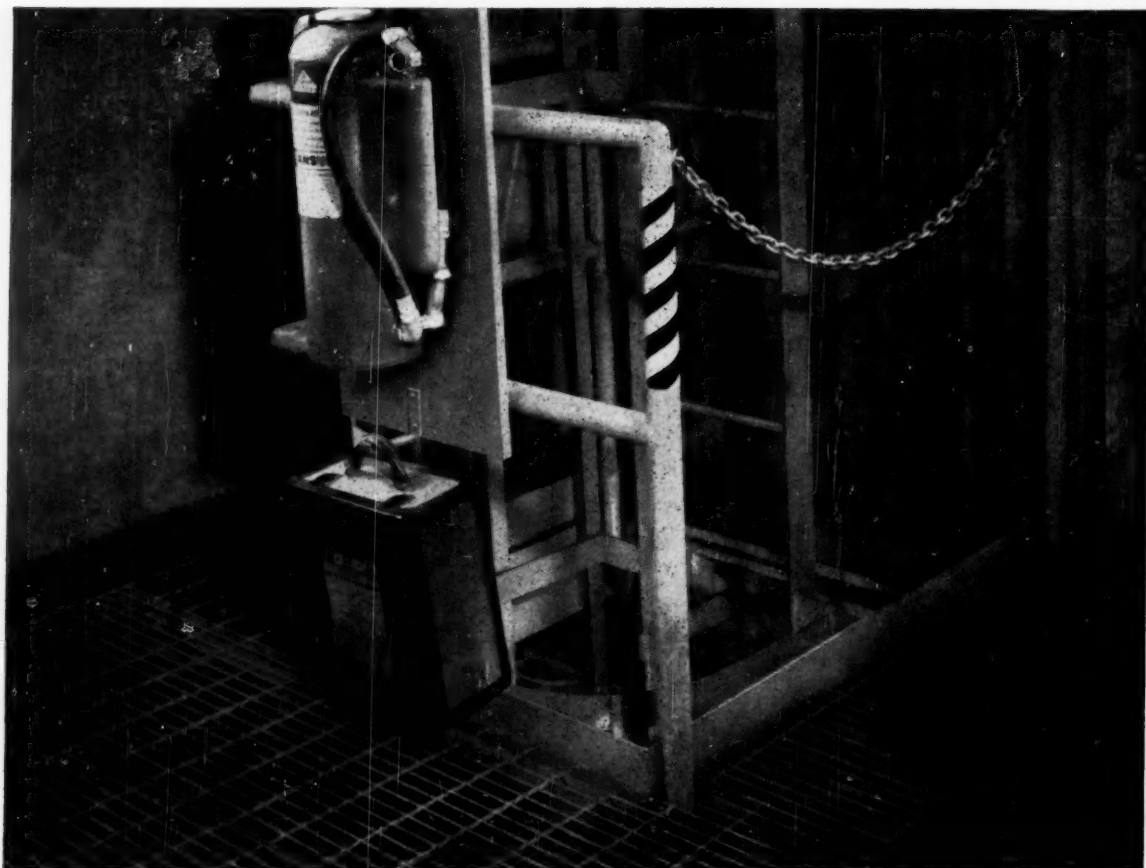
TOLUOL-XYLOL Sinclair produces and *delivers* the purest aromatics available. Sinclair is proud of this reputation and maintains it through care and high standards in manufacturing — insures it by use of special transportation equipment provided exclusively for aromatics.

If you use solvents in your formulations — get the highest in purity and uniformity. It costs no more. For complete information, call or write:

SINCLAIR CHEMICALS, INC.

(Affiliate of Sinclair Refining Company)

600 Fifth Avenue, New York 20, N. Y. Phone Circle 6-3600
155 North Wacker Drive, Chicago 6, Ill. Phone Financial 6-5900



A dangerous place to work... that's why you see so many symbols of safety

Here's a plant that's out to keep "employee down-time" at a minimum. Extinguishers and gas masks provide protection against fire and toxic fumes. Guard rails and chains surround permanent hazards. Raised steel strips around floor openings prevent objects rolling or being kicked to the floor below. Clean windows and bright lighting provide good visibility. It's only natural that a company so interested in safety should select Blaw-Knox Electro-forged® Steel Grating for "underfoot" safety.

Each section of Blaw-Knox Steel Grating is of rigid, one-piece construction. Choice of cross bar and bearing bar designs and spacings affords maximum safety under all working conditions. Indoors or out, you get safe, quiet, long lasting and self-cleaning flooring with maximum passage of light and air.

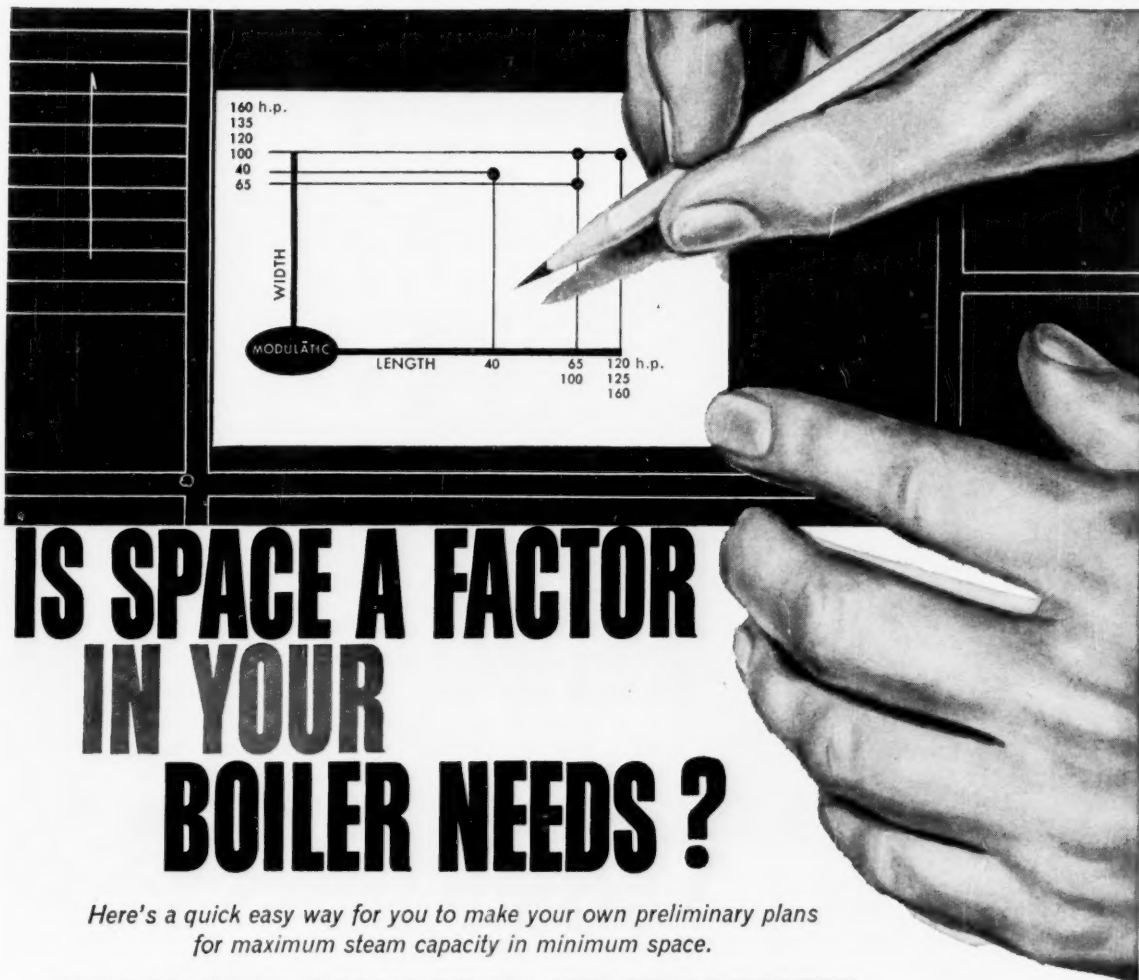
Blaw-Knox Electroforged Steel Grating is fabricated in a wide selection of materials to exact customer specifications. Fits easily and neatly into even the most congested areas.

Send for new Blaw-Knox Grating Catalog 2527. See new ideas in flooring, walkways, stair treads, platforms, shelving. Write today.



BLAW-KNOX COMPANY

Blaw-Knox Equipment Division • Dept. C, Pittsburgh 38, Pa.



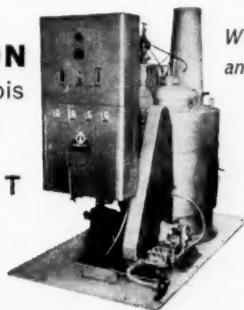
IS SPACE A FACTOR IN YOUR BOILER NEEDS ?

*Here's a quick easy way for you to make your own preliminary plans
for maximum steam capacity in minimum space.*

FREE 1/4 INCH SCALE TEMPLATE OF COMPLETE VAPOR MODULATIC WATER TUBE BOILER LINE MAKES BOILER NEED PLANNING SIMPLE

Set the template on your floor plan and select the size boiler you need — experiment with locations. Modulatic needs no enclosures, no chimney, no foundation. Put it where you want to use steam. On the roof, on a balcony, in an aisleway, hang it from the ceiling or put it in the basement. Proved by 25 years in America's toughest boiler rooms! 10 horsepower to 160 horsepower. From 5 pounds to 300 pounds pressure (higher when required).

VAPOR HEATING CORPORATION
80 East Jackson Boulevard • Chicago 4, Illinois



*Write for your free template
and Bulletin 586—a postcard will do.*

THE WORLD'S MOST COMPACT

POWER PACKAGE



Making better cells

The skills and experience of the men who renew electrolytic cells are a major factor in their economical performance.

Other significant factors include the quality, design and machining of

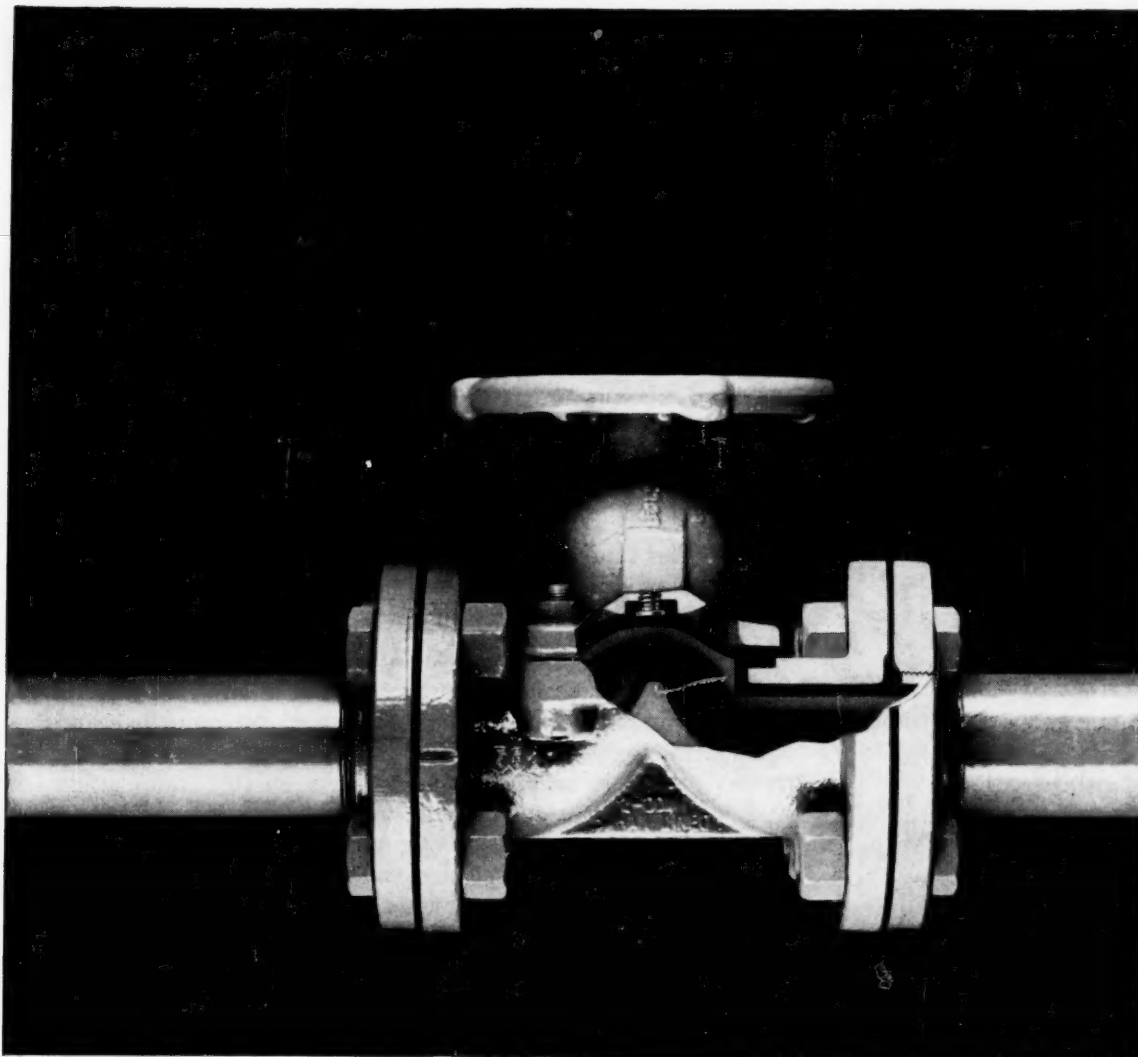
GLC anodes, which are carefully "custom made" to the requirements of individual cells.

FREE — This illustration of cell building has been handsomely reproduced with no advertising text. We will be pleased to send you one of these reproductions with our compliments. Simply write to Dept. N-1.



GREAT LAKES CARBON CORPORATION

18 EAST 48TH STREET, NEW YORK 17, N.Y. OFFICES IN PRINCIPAL CITIES



Corrosion protection is continuous in saran lined pipe—liquid never touches metal.

Here's why Saran lined pipe offers long range economy

*It's rigid steel pipe . . . lined with
corrosion-resistant saran . . . keeps shutdowns to a minimum for years*

Looking ahead? Do your plans call for a complete corrosion-resistant piping system with a low total installation cost . . . a system that requires a minimum of maintenance . . . that's simple to modify . . . that can be fabricated in the field?

Then it will pay you in every way to look into the genuine economy of a complete system of saran lined pipe.

First, consider the natural advantages of the new gray saran lining itself. Its lower coefficient of thermal expansion and contraction more closely approaches that of steel. This provides a broader operating temperature range and greater

resistance to thermal cycling. It can be installed in systems with operating pressures from full vacuum to 300 p.s.i. and temperatures up to 200° F. Add to these advantages the immediate availability of saran lined pipe, valves, pumps and fittings and you have an ideal piping system that can be installed without trouble, waiting or hidden costs.

If your plans call for lined tanks, you'll want the advantages of Saraloy® 898 tank lining added to your saran lined pipe system. Get the complete story on how it will pay you to install a complete saran and Saraloy 898 lined system. THE DOW CHEMICAL COMPANY, Midland, Michigan.

SARAN LINED PIPE COMPANY
DEPT. 2000-A
2415 BURDETTE AVENUE
FERNDALE 20, MICHIGAN

Please send me information on:

- ☐ Saran lined pipe, fittings and valves.
- ☐ Saran lined centrifugal pumps.
- ☐ Saraloy 898 chemical-resistant sheeting.

Name _____ Title _____ Company _____
Address _____ City _____ State _____

YOU CAN DEPEND ON

DOW

How to increase throughput through your PRESENT packed columns

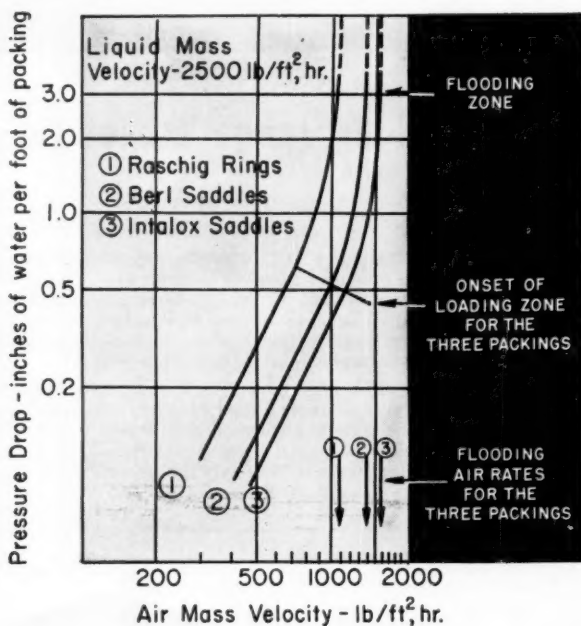


If your present packed columns are using either Raschig Rings or Berl Saddles you can increase throughput substantially by re-packing your towers with Intalox Saddle packing.

The data in the accompanying chart show typical pressure drop, loading and flooding points for all three packings in the 1" size, all operated under a liquid irrigation rate of 2500 lbs./ft.² hr.

You are ahead with Intalox Saddles in any way you operate your tower. Should you prefer to work substantially below the loading point, say at a gas rate of 500 lbs./ft.² hr., your pressure drop savings as compared to Raschig Rings would be about 65%, and as compared to Berl Saddles, about 25%. Should you wish to operate in the low loading range, as many towers are being operated, you will be able to pass about 50% more gas through the tower, as compared to Raschig Rings;

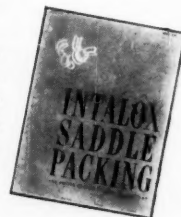
and about 15% more gas as compared to Berl Saddles. And these higher flow rates are realizable at a pressure drop that may actually be lower than you would have with Raschig Rings or Berl Saddles. Of course, the ultimate flooding limits of Intalox Saddles are also higher than for the other packings.



Like to know more about INTALOX SADDLES?

Write for a copy of Bulletin S-29 — full of data every engineer who is concerned with lower cost, more effective packed tower operation needs. Address Dept.

The U. S. Stoneware Co.,
Akron 9, Ohio.



U. S. STONEWARE
AKRON 9, OHIO

132F

Chemical Engineering

Developments

JAN. 13, 1958

Department Index

Chemotator	73
Process & Technology...	80
Calendar	86
Chemical Products	92
Process Equipment	98
Cost Index	102
Economics	106
Consumption Index ..	110

Chemical metallurgy scores again..... 80

Spurred by a rising demand for cobalt, Metallurgical Resources, Inc., is now winning the alloy ingredient from high-arsenic ores via the new Sill process.

CE Award goes for atomic age metallurgy..... 84

Some 78 chemical manufacturing firms, engineering organizations and laboratories receive CE's 14th annual award for chemical engineering achievement.

New process makes capsules more competitive..... 86

A French inventor has come up with a new encapsulating method for marketing non-water-miscible substances—from fertilizers to internal medicine—economically.

A radically new thermoplastic..... 92

Montecatini's polypropylene promises advantages for molded products, films and fibers. It boasts of high-heat resistance, of low cost and light weight.

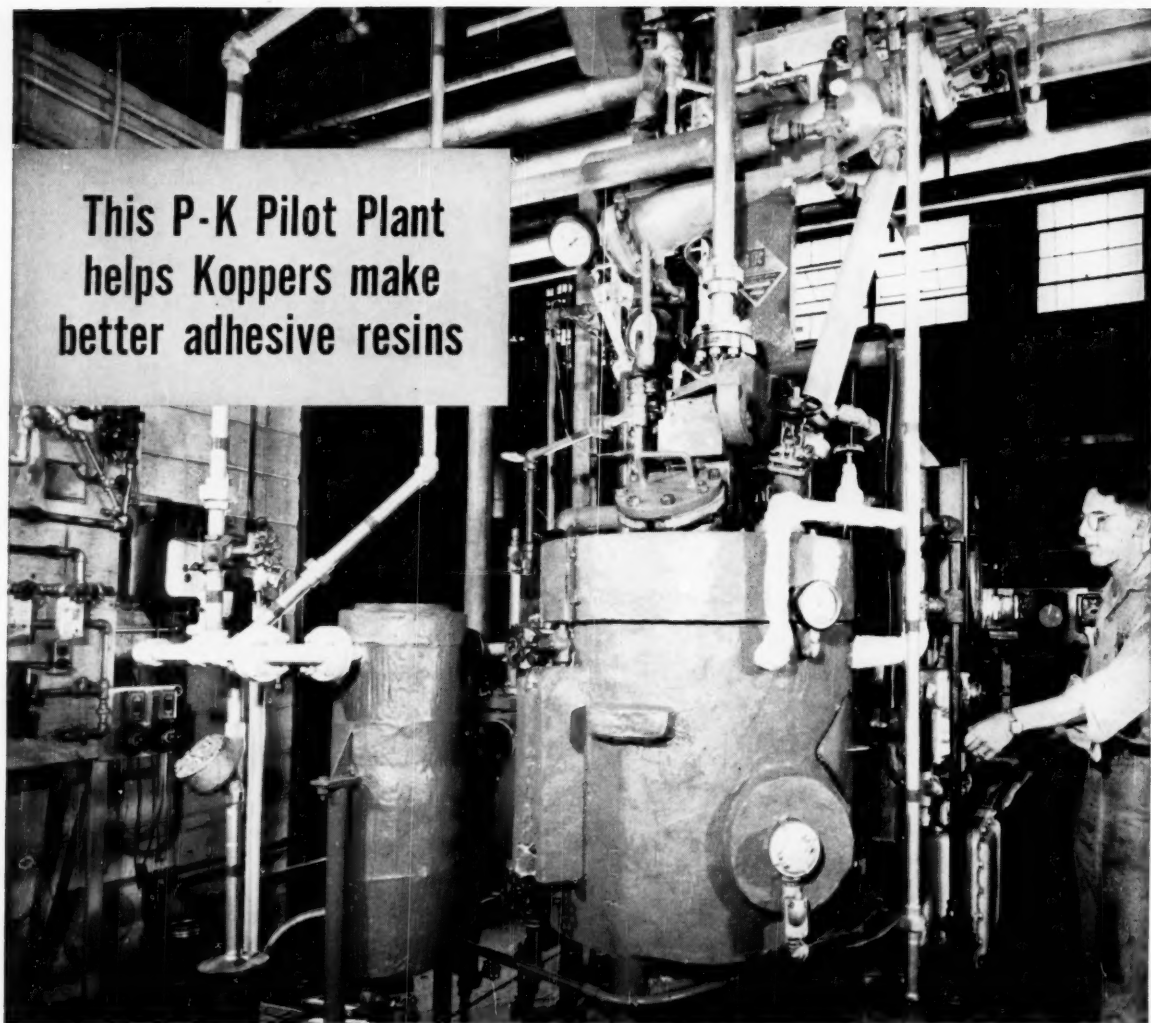
Toward a streamlined filtration cycle..... 98

Now, with the Durco-Enzinger model, an operator need no longer rely exclusively on pressure rise or elapsed time to tell him when the filter is full of cake.

Lagging capital spending due to a get a boost..... 106

Industrial spending which fed a hefty plant building surge, over the past three years, still nourishes a research boom—slated to spark capital outlays by 1960.

This P-K Pilot Plant helps Koppers make better adhesive resins



Technician checks pilot run of new Resorcinol resin at Koppers Verona (Pa.) Research Center.
15-gal. P-K Pilot Plant includes reactor, vapor reflux pipe, condenser, decanter, receiver, controls.

Resins, like many chemical products, are difficult to scale up from laboratory to plant production. Formulas must be painstakingly adjusted until the product of the reaction kettle is identical with that of the laboratory flask.

Koppers solved this problem of scale-up—and a lot of others, too—by installing a P-K Packaged Pilot Plant at its Verona Research Center.

This versatile unit determines production variables on new adhesive resin formulations with a minimum of cost and time. And, because it's a P-K Packaged Pilot Plant, Koppers even saved money and time before the unit made its first run — on design, engineering and delivery.

P-K Pilot Plants are made in 5 to 60 gallon capacities.

Design can be modified to meet special requirements, and larger sizes can be built.

These units speed *your* product development work in many ways. For example, the smaller plants are ideal for testing and sampling. Larger sizes can even be used for small production runs. In addition to helping you determine scale-up factors from lab to plant, a P-K pilot unit is a tool to find engineering design data for new processes...determine costs...define changes in existing processes to reduce costs...improve quality control procedures.

If there's a new product in your future, get the full story of P-K Packaged Pilot Plants. Just write to The Patterson-Kelley Co., Inc., 1501 Hanson Street, East Stroudsburg, Pa.

14P

Patterson



Kelley

Chemical and

Process Division

P-K "Twin-Shell" Blenders • Heat Exchangers • Packaged Pilot Plants • P-K Lever-Lock Doors • P-K Vacuum Dryer Blenders

JANUARY 13, 1958

Chementator

C. H. CHILTON

- ✓ Wyandotte has suspended construction work at Baton Rouge because of business conditions.
- ✓ Engineer shortage? Univ. of Texas will graduate 30% more engineers this year, yet 27 firms have cancelled appointments for campus interviews.
- ✓ Rilsan Co., French producer of nylon-11, is negotiating to license its process to a U. S. firm. Product is polymer of 11-amino undecanoic acid, derived from castor oil.
- ✓ Ultrasonic system for shattering oil from Alberta's oil sands is on trial by Sonic Oil Separation Ltd. Process is said to be much swifter than other known methods.

Boron propellants get solid backing

Teaming the high-energy punch of exotic chemical fuels with the simpler rocket design made possible by solid propellant systems, Callery Chemical has come up with a solid version of its boron-based HiCal.

Though still in the development stage, solid HiCal, compounded with an oxidizer (e.g., ammonium perchlorate or lithium hydroxide) in a rocket cartridge, has undergone highly promising test firings. Plans now call for its manufacture at Callery's new plant (due on stream in May) at Lawrence, Kan.

Like liquid HiCal, the term "solid HiCal" actually encompasses a series of alkyl borane compounds rather than any single material. While specific formulas are under government security wraps, one very likely member of the family is ethyl decaborane.

Key attraction of solid propellant systems is that they don't require liquid transfer equipment (pumps, storage tanks, piping, etc.). This permits lighter, less complicated, less costly and more efficient missiles or jets. Moreover, solid HiCal is easier to handle and exhibits a lower effective toxicity than liquid HiCal.

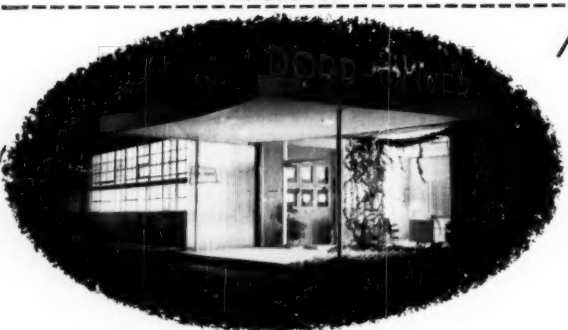
New fiber threatens nylon, Dacron

Latest synthetic fiber development to excite chemical men is a polymer called Urylon, now being made experimentally by Toyo Koatsu Industries in Japan. It's a polycondensation product of nonamethylene diamine and urea and is categorized generically as a "polyurea" fiber.

Construction will start soon on a Urylon plant next to the company's ammonium sulfate and urea facilities at Sunagawa on the island of Hokkaido. Schedule calls for initial output of 1 ton/day by year's end, gradually increasing to 15-20 tons.

The nine-carbon diamine is made from azelaic acid by ammoniation and dehydration

(Continued on page 76)



1957 has been a year of contrasts.

Significant advances in technology, the completion of a substantial portion of our program to expand our productive capacity in the U. S. and Canada and the strengthening of our marketing organization are all tangible achievements which will bring us both immediate and long-term benefits. On the other hand, a generally lower activity in new projects coming in has emphasized the narrowing profit margins faced by most businesses and points up our insistence on improving designs, reducing costs and increasing efficiencies.

Abroad, the picture is bright. Our subsidiaries report current high levels of business and there is great optimism for the future. Of particular interest is the success of our newest family member, Dorr-Oliver Pty. Ltd. of Australia, which opened its doors on January 1 of this year and by mid-year had far surpassed expectations. Growth of Dorr-Oliver (India) Ltd., another of our newer associates, has also been noteworthy, with the recent addition of local manufacturing facilities justifying still greater optimism.

SUGAR — In 1957 a total of 42 RapiDorr Clarifiers and 48 Oliver-Campbell Cane Mud Filters were sold to the cane sugar industry. A significant aspect of this outstanding record has been the increasing participation of our subsidiaries and representatives abroad. They are locally manufacturing, in some instances for the first time, 31 of these machines in Argentina, Brazil, England, France, Germany, India, the Philippines and South Africa.

POLYETHYLENE — The first Merco Pressure Centrifuges went into operation early last year removing catalyst from liquid polyethylene at capacities considerably in excess of original expectations. Overseas, British, Italian and German producers ordered Pressure Centrifuges for similar application in both new commercial scale and pilot plants.

SANITATION — One of the highlights of the year was D-O activity in the waste water disposal field. Four major new developments—all ideally suited for smaller plants—were introduced. The SpiroVortex System which is a complete treatment process akin to activated sludge, the Degritting Clarifier and Clarigester and the DorrClone Classifier as applied to sewage degritting have already been commercially proven at plants in the western U. S. First installations of the CompleTreator, a package plant to serve a population of 150, are now operating with some 30 additional units scheduled to start up in 1958.

Our subsidiary in the Netherlands has marketed equipment for facilities as far distant as Norway, Iraq and India, while new or enlarged D-O equipped domestic installations sold in 1957 can be found from New York City to Los Angeles and San Antonio, Texas to Fairmont, Minnesota.

GENERAL METALLURGICAL — Applications of the DSM Screen, first introduced in 1956, continued to grow in virtually every field we serve. One of the most promising has been magnetite recovery in heavy media cyclone plants on the Mesabi Range. Also new is the swing-type agitator for the American Filter — a development particularly applicable to filtration of heavy metallurgical slurries.

Following the trend noted in previous years, widespread acceptance of the Slurry Mixer by the cement industry and the Thickener — American Filter combination by the coal industry continued again last year. In Germany, France, India and Australia flue dust clarification and recovery contributed materially to our business and in Canada a substantial volume of Dorr-Oliver-Long shaft equipment and mine cars was purchased for underground mines.

PLANT ENGINEERING — At the year's end, design of a granular fertilizer plant for India and sections of a new Cuban nickel recovery plant were partially completed, and construction of three D-O designed phosphoric acid or fertilizer plants was progressing in Venezuela, England and Montana. During the year a 200,000 ton per year triple superphosphate plant in Florida and a Norwegian phosphoric acid installation were put into operation and brought up to design capacity in near record time.

FLUOSOLIDS SYSTEMS — Also in the fertilizer industry two western producers ordered the first FluoSolids Systems to be used for calcination of phosphate rock. Designed to handle a total of 1,500 tons per day, these installations were the direct result of successful field tests using a portable fluidized bed pilot plant. During the year other FluoSolids Systems were ordered to dry limestone and blast furnace slag in the U. S., roast copper matte in Belgium, calcine clay in Scotland, decompose copperas in England, and roast pyrite for a Japanese paper mill and an Italian sulfuric acid manufacturer.

The largest FluoSolids System for fine coal drying, handling over 600 tons per hour, went into operation during the third quarter at a new eastern preparation plant, and construction is nearing completion on a second similar, but smaller, installation. In the realm of unusual applications is a unit drying a highly-corrosive chlorinated hydrate at an eastern chemical plant.

PETROLEUM — Another modification of the familiar DorrClone Classifier is the ClayJector, latest development for control of drill mud weights. Noteworthy economies are possible using this unit which mechanically rejects undesirable drilled solids while recovering valuable barites for reuse.

PULP AND PAPER — Another operating "first" recorded during the past year was initial operation of the first complete D-O Pulp Bleaching System. Located at a northern New York state mill, it is the result of an extensive program to develop a new and improved continuous bleaching system for the pulp industry. Abroad, the Swedish representative of our Dutch subsidiary has just completed an outstanding year marked by one of the largest orders in their history for Bleach Washers and by orders for a number of new or expanded Recausticizing Systems.

FluoSolids, DorrClone, PeriFilter and RapidDorr T.M. Reg. U. S. Pat. Off.

WATER TREATMENT — In the southwestern United States the DorrClone Classifier has been used with notable success for the desanding of municipal well water supplies. For small plants the PeriFilter System with a single pre-treatment unit and split filter provides economical unitized water treatment.

Major expansions of the Louisville, Kentucky and Fort Worth, Texas treatment facilities will be D-O equipped as will new municipal plants at Springfield, Ohio; Peoria, Illinois; and Delhi, India. New industrial treatment installations will serve pulp mills in South Carolina, India and Venezuela and an Indian fertilizer plant.

CHEMICAL — A substantial amount of D-O equipment of all types has been incorporated into the unique flow-sheet of a new astrakanite recovery plant in the Chilean nitrate fields. In Germany and the United States, Horizontal Filters have been widely applied to dewatering and washing of fine organics as well as highly corrosive inorganics, and around the world filters of both standard and special construction were ordered for an almost endless variety of services.

FOOD PRODUCTS — A mid-western producer has ordered twelve centrifugals of three basic types for washing and concentrating soya protein solids. Last year the largest U. S. corn starch producer put into operation a Merco-DorrClone starch washing system, and in 1958 the first DorrClone germ separation station in the same industry will go on stream. Also in centrifugals, a smaller model of the Mercone Screening Centrifuge is now available for intermediate or small scale operations.

COPPER AND URANIUM — Last year substantial amounts of D-O processing equipment were purchased for new and enlarged copper mills in South America, Mexico, the Belgian Congo and United States and new uranium mills in Australia, United States and Canada. A new and improved design and method of fabrication of stainless steel rake Classifier blades was developed. Although conceived initially for the uranium industry this design is broadly applicable to classifications involving corrosive solutions. Certainly no summary of 1957 accomplishments would be complete without mention of the Chemical Engineering Achievement Award presented last month to a group of companies including Dorr-Oliver for their contribution to extractive metallurgy of atomic age metals. Interestingly enough, D-O was one of the very few engineering equipment organizations selected for the award.

With several years of expansion and enormous activity behind us, the current business plateau provides a much needed opportunity to consolidate and catch our breath. The real challenge will be to increase the spread between income and outgo through more efficient operation — while accelerating the rate of our technological advances. I am confident we can, and will, do both.

J. D. HITCH, JR.
President

November 18, 1957

to the dinitrile, followed by hydrogenation to the diamine. Commercial success of Urylon would mean a big boost in consumption of azelaic acid, as well as in use of ozone as oxidizing agent for making the azelaic from fatty acids.

Accounting for Toyo's optimism are such Urylon properties as these:

- Wet strength is same as dry strength (5-5.5 g./d.), making it especially good for fishing nets.
- It is lighter than nylon or Dacron (sp. gr. 1.07).
- Young's modulus (500-600 kg./mm.²) is double that of nylon and Dacron.
- Melting point (240-250 C.) is comparable to that of Dacron, higher than nylon.
- Elongation (15-20%) is equal to that of Dacron, lower than nylon.

Toyo now has patents on Urylon in Japan, France, Britain and Switzerland. U. S. patents are pending.

Polypropylene: Who's on first?

Three recent announcements in rapid-fire succession turned the commercial debut of polypropylene into a pointless scramble to lead the parade:

• Nov. 26—Farbwerke Hoechst announced commercial production at Frankfurt, Germany, at a rate of 700 tons/month.

• Nov. 28—Hercules rushed out a news release on the "world's largest" commercial polypropylene plant, at Parlin, N. J., with an annual capacity of 20 million lb.

• Dec. 2—Montecatini put on exhibit at the Chemical Show in New York its new polypropylene made in commercial facilities (15 million lb./yr.) at Ferrara, Italy (see p. 92). Production actually began in September and was announced on Oct. 17.

Hercules' announcement—which caught most of the industry by surprise—caused some lifted eyebrows with its claim that Hercules' polypropylene production involved no licensed know-how from either Karl Ziegler or Montecatini's Giulio Natta. This despite these facts:

• Natta's priority in the field of isotactic polypropylene has gone publicly unchallenged.

• Montecatini has licensed Natta's polypropylene know-how to Ziegler in Germany (Hoechst presumably sublicenses from Ziegler).

• Hercules' production of linear polyethylene involves a Ziegler license and a working agreement on operating know-how with Hoechst.

With everyone playing his cards close to the vest, holder of the trump cards won't be known until patent applications now pending are issued.

Chemical metallurgy suffers setback

While "chemical metallurgy" has many recent gains to its credit, one metal producer now registers disenchantment.

Calera Mining Co., subsidiary of Howe Sound Mining Co., has just converted its cobalt production facilities at Garfield, Utah, from hydrogen reduction to a more-conventional electrolytic operation. The firm expects electrowinning to be more efficient and less costly than hydrogen reduction, with an anticipated 4-5% increase in output of cobalt. Production has been running some 4 tons/day.

Cost of conversion, which will include adding a relatively inexpensive "denickeling" process this year, comes to \$750,000. The original digestion circuits remain unchanged.

High-pressure hydrogen reduction as a means of winning metal values from aqueous solutions was developed by Chemical Construction Corp. in the early 1950's. Process was adopted by two other producers in addition to Calera—National Lead, Fredericktown, Mo., for cobalt, and Sherritt Gordon Mines, Fort Saskatchewan, Alta, for nickel (*Chem. Eng.*, Jan. 1957, pp. 194-197).

The latter firms both report eminently satisfactory operations, with no apparent intention of making any fundamental process changes. And a Chemico engineer who participated in these developments expresses surprise at Calera's move, suggests that specific purification problems might account for it.

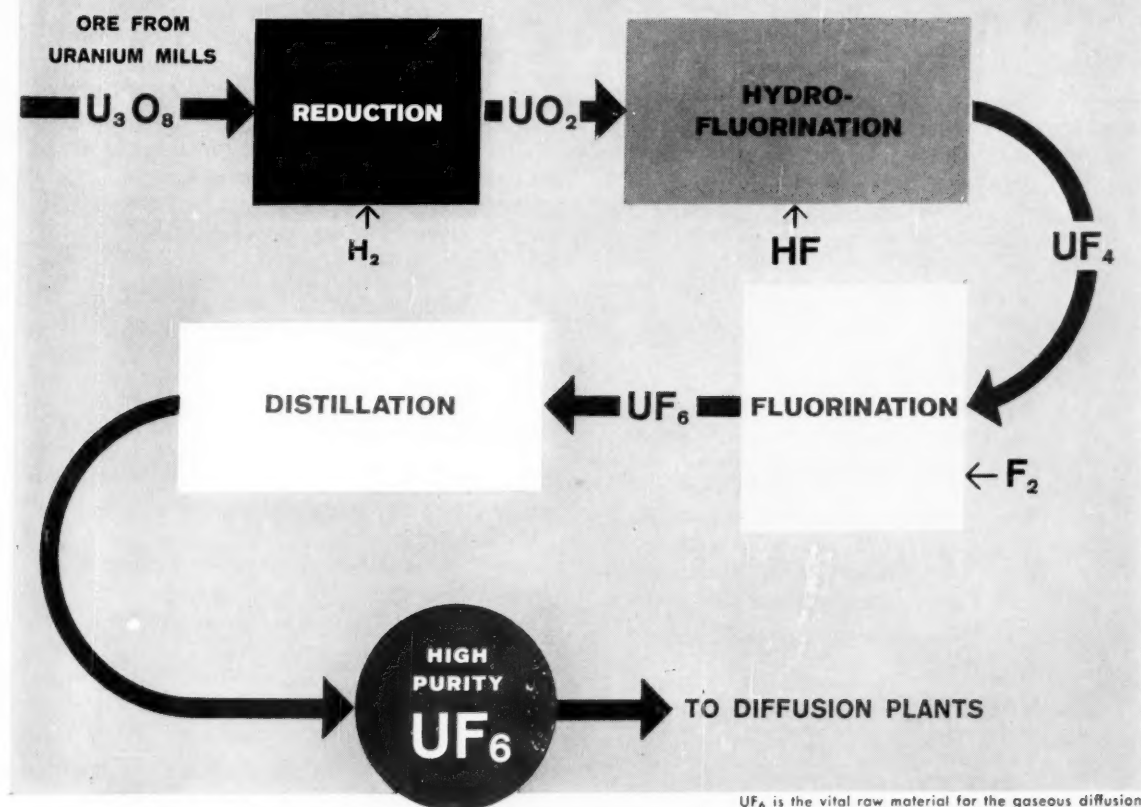
New way to make terephthalic acid

A new approach to production of terephthalic acid—one which would free TA makers from dependence on costly para-xylene—is getting serious study here and abroad.

Process was discovered by Bernhard Raecke of Henkel & Co., leading soap manufacturer of Duesseldorf, Germany. Badische in Germany, Hercules in U. S., Kawasaki

(Continued on page 78)

Chemical Processing for Atomic Energy



UF₆ is the vital raw material for the gaseous diffusion process, which separates UF₆ into U²³⁵F₆ and U²³⁸F₆.

NEW PROCESS FOR URANIUM HEXAFLUORIDE

wins General Chemical a share in 1957 Chemical Engineering Award



processes in extractive metallurgy of the Atomic Age metals."

General Chemical's significant contribution is the research and development of a new process for producing

One of the highest honors in the chemical industry—The Chemical Engineering Achievement Award—was recently presented to General Chemical and others for "pioneering applications of chemical engineering principles and

refined uranium hexafluoride for the Atomic Energy Commission. General will be the first company to refine uranium oxide compounds for the AEC in privately owned and operated facilities. Its new UF₆ plant, now under construction at Metropolis, Illinois, is scheduled to go on stream early in 1959.

General's new process for UF₆ embodies advances in fluorine technology that stem directly from its broad experience as the country's foremost producer of elemental fluorine, hydrofluoric acid, halogen and other fluorides . . . One more example of General Chemical serving the nation and industry—through leadership in fluorine chemistry.

First in fluorides

GENERAL CHEMICAL DIVISION

Allied Chemical & Dye Corporation
40 Rector Street, New York 6, N. Y.



Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland (Miss.) • Cleveland (Ohio) • Denver • Detroit • Houston • Jacksonville • Kalamazoo • Los Angeles • Milwaukee • Minneapolis • New York • Philadelphia • Pittsburgh • Portland (Ore.) • Providence • San Francisco • Seattle • St. Louis • Vancouver (Wash.) • Yakima (Wash.) In Canada: The Nichols Chemical Co., Ltd. • Montreal • Toronto • Vancouver

Chemical and Teikoku Rayon in Japan and ICI in Britain have taken out licenses. First three firms are known to have pilot plants.

Basis of process is the fact that salts of aromatic acids will isomerize to their energy-poorest symmetric structure under the influence of heat and catalyst. For instance, potassium orthophthalate isomerizes to the terephthalate at 400 C. with yields of 95%. Catalyst is a cadmium salt. TA is liberated with a suitable "springing" agent, such as HCl.

In another process variation—one which Hercules favors—potassium benzoate is disproportionated to get the terephthalate plus benzene. Here the basic raw material, toluene, is much cheaper than phthalic acid.

Chief engineering problem, says Hercules, is how to handle the salts at process temperatures.

Key to process economics is low-cost recovery and reuse of the potassium values. Hercules has studied several alternative routes, is now weighing process data and market conditions.

High heat fluxes portend nuclear planes

Two workers at Oak Ridge National Laboratory have recently scored a major breakthrough in heat-transfer science by demonstrating heat fluxes as high as 17 million Btu./hr. (sq. ft.) in the boiling of water. This value is about ten times larger than any previously reported in the literature for similar experimental conditions.

Key to these high heat fluxes is a new heat-transfer mechanism due to the helical vortex flow pattern of the water within the electrically heated copper or Inconel tube. Water enters the tube via a tangential inlet at right angles to the tube axis.

Investigators W. R. Gambill (well-known author of *CE's* physical data estimation series) and N. D. Greene point out that in this type of flow the inner surface of the tube is more nearly free of steam bubbles at a given heat flux than in ordinary straight-through flow, because action of the intense artificial gravitational field displaces the bubbles toward the tube axis, thereby permitting the attainment of faster heat transfer.

In the test which gave the 17-million-Btu. flux, velocity of the water in the axial direction was only a modest 24 ft./sec. To have obtained this flux with straight-through flow

would have required an estimated flow velocity of 2,500 ft./sec. for the same conditions of pressure and degree of subcooling.

What good are such high heat fluxes? Gambill and Greene point out that a heat source with outside dimensions of 1 ft. dia. and 1 ft. height, containing a closely packed bundle of 1/4-in. tubes, could transfer heat to a coolant at a rate of 570 megawatts/cu. ft.

Expressed in these terms, it's apparent that compactness is a major virtue. This suggests that the nuclear-powered aircraft program may be behind this type of heat-transfer research (*Chem. Eng.*, Aug. 1957, p. 162).

Electric heat cuts carbon baking time

Eight minutes instead of eight weeks—this is the banner under which National Carbon Co. ushered in its new carbon baking process last month.

Now in operation in a new plant at Lawrenceburg, Tenn., National's process uses specially designed hydraulic presses to form carbon products (e.g., bricks for furnace linings), while at the same time passing a low-voltage, high-ampere current through the material to heat it to baking temperature (2,000 F.). Conventional procedure is to press "green" shapes from a mixture of carbon flour and pitch binder, then bake them in big gas-fired ovens for several weeks.

New process, says National, garners these advantages:

- Short cycle obviates the usual huge in-process inventory, permits closer quality control.

- Products have unique low-permeability properties.

- It's now possible to automate carbon production to a high degree.

Without detracting from the significance of National's engineering achievement, industry observers point out that these advantages don't come cheaply. Several minutes per brick is a long time to tie up an expensive hydraulic press, whereas presses can ordinarily turn out green bricks at a clip of several hundred per hour.

Low-voltage, high-current power (as high as 100,000 amp.) can also be expensive.

In addition, it's likely that the new technique is limited in the physical size and composition of carbon products that can be made.

For more on DEVELOPMENTS.....80

Where odor is a problem use these **SHELL SOLVENTS**

SHELL SOL 71 AND 72

... have no odor, are ideal for interior finishes, polishes and cleaners. Shell Sol 71 offers slightly faster evaporation.

SHELL 360 SOLVENT

... faster evaporation, low odor, over 100° F. flash point.



SHELL SOL 140

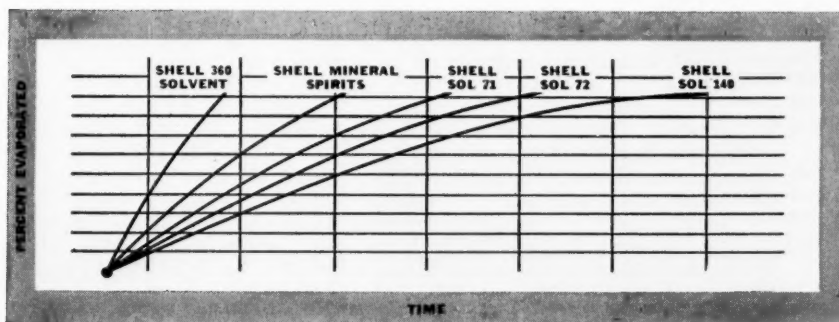
A high-flash, slow drying solvent with a very mild odor.

SHELL MINERAL SPIRITS

... traditional distillation range, solvent power and drying. Mild odor.

These solvents are recommended for low odor and odorless products.

Typical properties of these Shell Solvents are contained in booklet shown. It will be mailed on request.



SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA



Leach Licks Arsenic Bugaboo in Metal Ore

Pressure leach purges arsenic from ore, opens door to lower-cost recovery of pure metal. Byproduct calcium arsenate and sodium sulfate add revenue.

"Chemical metallurgy" has won another adherent. Spurred by rising demand for cobalt (used mainly in high-temperature alloys), Metallurgical Resources, Inc., Newburgh, N.Y., is now winning cobalt from high-arsenic ores via the new hydrometallurgical Sill process.

MRI's semiworks plant in Newburgh is now handling around 10 tons/day arsenical ore, tuning up Sill process to make its first bid for commercial status. Success will certainly lead MRI to expand present \$1.7-million plant to a full-scale 30-60-ton/day unit, may also portend application of Sill process to other arsenical ores, such as North Carolina lithium ore.

► **Arsenic Complex**—Like the better mousetrap, there has long been need for a better way to process arsenical metal ores. Roasting, the conventional treatment, pollutes surrounding atmosphere. And gasified arsenic and sulfur passing up the stack certainly do not fatten the reclaimed-values kitty.

Too, roasting does not remove all arsenic. Residual arsenic in the roasted ore shows up later as a contaminant during metal recovery.

One approach to this headache is removal of metal values from raw ore by acid or ammonia pressure leaching. Worked out by Chemical Construction Co., this method is used by Howe Sound Mining, National Lead and Sherritt Gordon.

► **Sill Leaches Arsenic**—But the process worked out by Harley

Sill, Los Angeles metallurgical engineer, takes a different tack. Sill originated a leaching step—alkaline ore oxidation in an autoclave—that solubilizes arsenic and sulfur so that they leach out of ore. Then, leach residue can be processed to give up uncontaminated cobalt, lithium or other desired metals. Process bonuses: Arsenic and sulfur values can be recovered from leach extract; there's no pollution problem.

► **Ore Picture**—Feed to MRI's semiworks plant is high-arsenic ore concentrate from Cobalt, Ont., area. Typical analysis runs As, 45%; S, 20%; Co, 12%; Fe, 19%; Ni, 3%; Cu, 1%; Ag, 100-150 oz./ton. Arsenic shows up in cobaltite (CoAsS); sulfur also appears in two other compounds, CuFeS₂ and FeS₂.

Because this type of arsenical ore is difficult to process by conventional methods, it is available at lower cost than low-arsenic ore. For a given cobalt content, price varies inversely with arsenic content.

With the Sill process, MRI feels it can gain a favorable cost position. Benefiting from lower cost of its raw material, MRI expects to turn out arsenic-free cobalt at a lower cost per pound than can producers using conventional roasting.

► **Pressure Cooking**—Heart of the Sill process is the leaching step (patents on step have been granted in several foreign countries, are still pending in U. S.).

Pulverized ore concentrate

from ball mill (over 90% through 200 mesh) is mixed with slightly more NaOH solution than stoichiometrically required to oxidize arsenic and sulfur content to sodium arsenate and sulfate. Resulting solution runs around 8-10% NaOH. This is pumped continuously to the autoclaves.

Piped for parallel operation, these two 8 x 26-ft. horizontal carbon-steel vessels are the only custom-made equipment in plant. Vertical baffle plates divide each vessel into four mixing compartments.

During 4-hr. holdup in autoclaves at 120 psi. and 240 F., turbine mixers beat air into the solution. Under these oxidizing conditions, arsenic and sulfur go into solution.

Reaction is exothermic, but requires heat to trigger oxidation. Coils in each mixing compartment provide heating and cooling as needed.

► **Old and New**—Sill process is a happy marriage of the new autoclaving step with subsequent conventional metal recovery. Following the continuous autoclaving operation, material passes through a series of batch operations based on classical procedures for separating cobalt from nickel.

Two 480-sq.-ft. Moore leaf filters separate slurry from the autoclaves into metal-bearing cake and arsenate-sulfate solution. Cake contains only 0.1% arsenic and a trace of sulfur and is now ready for recovery of the valuable metal constituents. Filtrate yields its

arsenic and sulfur values in another branch of the process, discussed later.

Metals-laden cake from Moore filters is dissolved in sulfuric acid and filtered on a Burwell plate-and-frame filter. Iron, copper, cobalt and nickel go off in filtrate; silver and gangue are left in cake. Silver can be recovered by melting with borax glass and carbonate if there's enough silver to make it economical.

Two consecutive precipitations remove iron: Lime is added to pH 4.8 and ferric hydroxide filtered. Then filtrate is aerated to oxidize ferrous iron to ferric and addition of NaOH drives reaction to completion. Filtration removes last of the iron as ferric hydroxide.

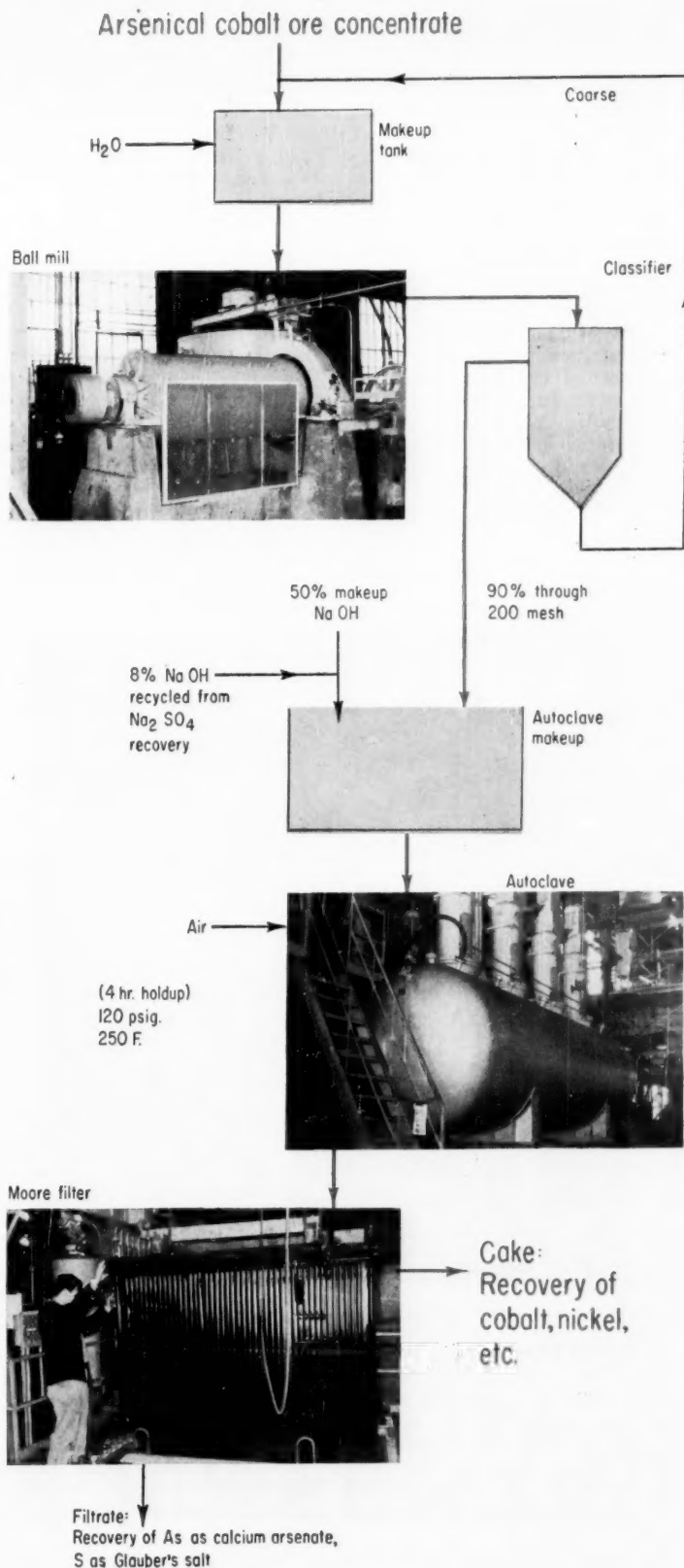
Sodium hydrosulfide is added to filtrate, precipitating copper sulfide. Filtrate from plate-and-frame filtration contains all the nickel and cobalt values.

► **Cobalt Comedown**—Gaseous chlorine is bubbled into filtrate to oxidize cobaltous ion to cobaltic, then soda ash is added to about pH 6.5. A mixed precipitate of cobaltic hydroxide and cobaltic carbonate is filtered off and roasted to the oxide in a Herreshoff roaster at 1,650 F. for about 45 min.

About two-thirds of the cobalt comes down in the first precipitate. Further soda ash addition to filtrate brings pH to around 6.8; a mixture of nickel and cobalt carbonates precipitates. This is filtered and the cake recycled to the metals dissolution section.

Finally, the remaining nickel is precipitated by addition of soda ash to over pH 8. A 1,650 F. roasting converts filtered nickel carbonate to nickel oxide.

► **Arsenic and Sulfur**—As noted previously, clear solution filtered from autoclaved ore slurry contains arsenates and sulfates. Lime is added, precipitat-



ing calcium arsenate, which is filtered and sold as wet cake for insecticides.

Two-stage crystallization recovers sulfur as anhydrous sodium sulfate. Filtrate from arsenate precipitation flows into a vacuum crystallizer operating at 50 F. Crystals of glauher salt (Na_2SO_4 decahydrate) come down from the caustic-sulfate liquor. Basket-type centrifuge sends washed crystals to second crystallizer and recycles caustic back to autoclave makeup.

Glauber salt crystals melt in the recycling mother liquor of the second vacuum crystallizer, operating at 190 F. Crystals of

anhydrous sodium sulfate come down, are centrifuged and dried in Wyssmont Turbo dryer at 200 F. Product sodium sulfate has a moisture content of about 0.5%.

TV, Computers Find New Refinery Jobs

The oil refiner has found two new tasks for a couple of basic "wonders" of our electronic age—television and the electronic computer.

Humble Oil & Refining Co. has a new closed-circuit television station on duty at its Baytown, Tex., refinery. Camera's job is

to watch flame in an inert gas generator serving two hydroformers. Image is transmitted to a 14-in. viewing screen in one of the hydroformer control rooms.

Before television system was installed, operators had to view flame through a peep hole, some 100 ft. from control room. A "doghouse," built around peep hole, protected operator from the weather. Now operators view flame in comparative comfort of the control room.

And a new first in computer use is claimed by the Texas Co. at its Port Arthur, Tex., refinery. It has purchased the first digital computer for fully automatic control of an oil refinery process.

Texaco will use computer, engineered by Ramo-Wooldridge Corp., to run a polymerization unit making high-octane gasoline components.

Texaco is confident computer will pay for itself through increased plant output and greater quality control, although same number of operators are needed.

More Polyethylene Swings on Stream

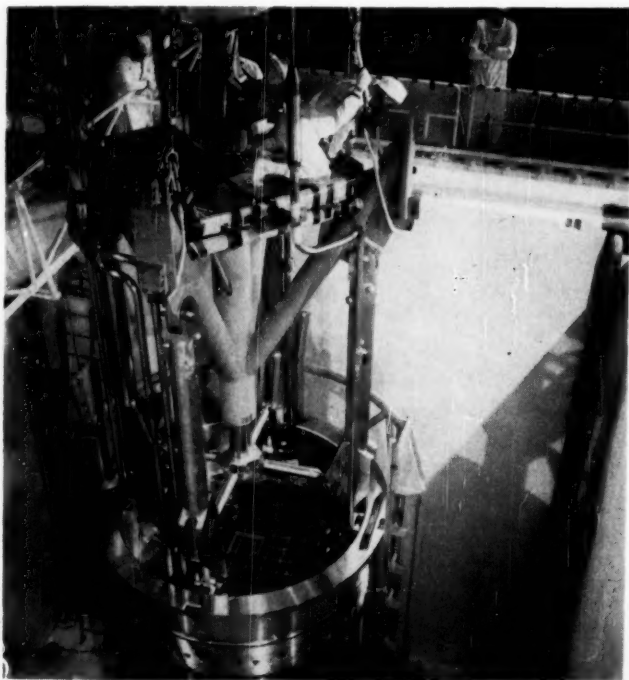
W. R. Grace's new 50-million-lb./yr. high-density polyethylene plant at Baton Rouge, La., is now on stream—but not without a last-minute crisis.

Grace's \$18-million plant, based on Phillips Petroleum's process, had contracted to buy raw-material ethylene from a plant four miles away. But this plant was not finished by the time Grace was ready for startup. Grace engineers sidestepped this bottleneck by bringing in ethylene from east Texas in a hastily-assembled fleet of high-pressure trailer trucks.

Product—Grex polyethylene—was produced in time to meet Grace's contract commitments.

For economical construction and freedom from product contamination, aluminum construction was used wherever possible. One aluminum first: Two large horizontal steam tube dryers are first all-welded aluminum dryers in use.

Fluor Corp. handled engineering and construction; plant was erected in just under 15 months.



Heart Operation: Core Lowered in at Shippingport

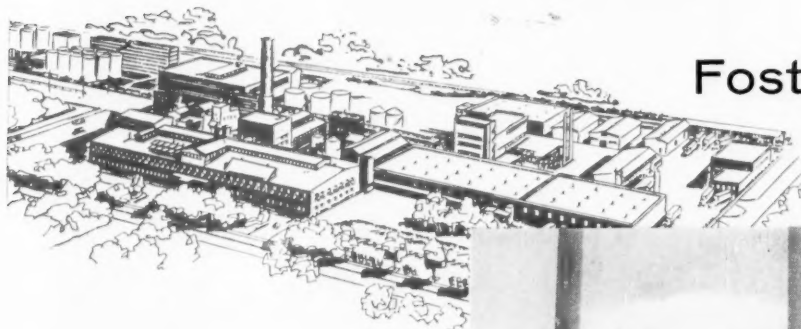
Heart of nation's first full-scale atomic power plant is shown being lowered into place at Shippingport, Pa. Core contains 165 lb. highly-enriched uranium surrounded by some 14

tons of natural uranium. Placing 58-ton core was a delicate operation because there's only 0.06 in. clearance between core and walls of pressure vessel. Reactor started operating Dec. 2nd.

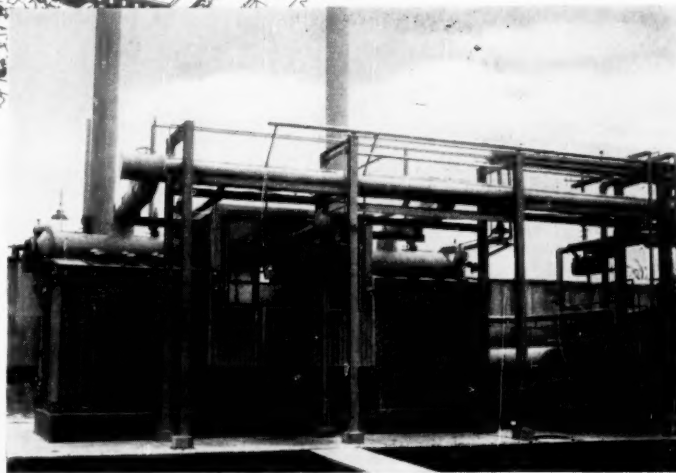
Another Major Food Processor Solves a

HOT PROBLEM with LOW-PRESSURE HEATING

by
Foster Wheeler



FW Vaporizers using Dowtherm keep steady 450 F temperature with only 6.5 psi Dowtherm pressure at Foods Division of Anderson, Clayton & Co.



THE Foods Division of Anderson, Clayton & Co., one of the largest producers of shortening, margarine and edible oils for the food industry, has found Dowtherm the ideal medium for process heating. In the deodorization of edible oils, heat was originally provided by 600 psi steam at 488 F or special, high flash point heating oils.

In contrast, the two FW vaporizers using Dowtherm, shown above, provide extremely accurate control, safer and more economical low-pressure piping arrangements and maximum flexibility for low-cost operation. Installed at the Sherman, Texas, Plant, each unit has an output of 4½ million Btu per

hour and is used to heat bleached and hydrogenated oils in the vacuum still to 450 F with fraction-of-a-degree temperature control. The Dowtherm pressure in the heating coils is only 6.5 psi at 525 F.

On any process, Foster Wheeler offers the benefits of 23 years of experience in the design and application of heating systems using Dowtherm. Only Foster Wheeler does the *complete job*—designs and builds the vaporizer, installs it in the plant, puts it on stream and makes sure that everything functions at top efficiency. More information is available in Bulletin ID-54-5. Write to Foster Wheeler Corporation, New York, N.Y.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.



At Waldorf, AEC's Jesse Johnson accepts Chemical Engineering Achievement Award on behalf of 78 winner representatives crowding dais, predicts wide use of atomic metals knowledge in other fields.

Industry Honors Atomic-Metals Pioneers

On December 3, 1957, 78 chemical process firms, engineering organizations and laboratories were honored with bestowal of the 14th biennial Award for Chemical Engineering Achievement in recognition of chemical engineering's contribution to atomic age metallurgy.

► **Whitman Presents** — Before upwards of 1,300 notables from industry, education and government gathered at the Award dinner in the Waldorf Astoria grand ballroom, New York, Award Committee Chairman Walter Whitman presented the Award on behalf of the sponsor, *Chemical Engineering* magazine.

Dr. Whitman, head of MIT's department of chemical engineering, described results of the winners' work as a renaissance of chemical metallurgy which, "promises to find ever-widening application to many of the older as well as the newer metals to which our committee somewhat arbitrarily limited its attention this year."

► **Johnson Accepts** — This

thought was developed further by Jesse C. Johnson, AEC's Director of Raw Materials and spokesman for the Award-winning group represented on the Grand Ballroom dais. Accepting the Award, Johnson said,

"The knowledge gained in providing materials for the atomic energy program most certainly will find wide application in other metallurgical and industrial fields.

"For metal recovery, I am thinking particularly of the ion exchange and solvent extraction processes.

"Also, high purity materials required in atomic energy have led to a general study of the effects of trace impurities on the properties of metals.

"More precise analytical procedures have had to be developed for use in production plants.

"The properties of all elements are being restudied, particularly those of the rarer elements, many of which have had no industrial use in the past."

► **Jeffries Keynotes** — Keynote

speaker and distinguished metallurgical engineer, Zay Jeffries, stressed the potential impact of the winners' achievements on the broad picture of human activities, and the future challenge it implies.

Summing up the challenge as the need to tool up for an armed truce, Dr. Jeffries explained that armed truce is the next stage before our ultimate goal of peace with abundance and freedom.

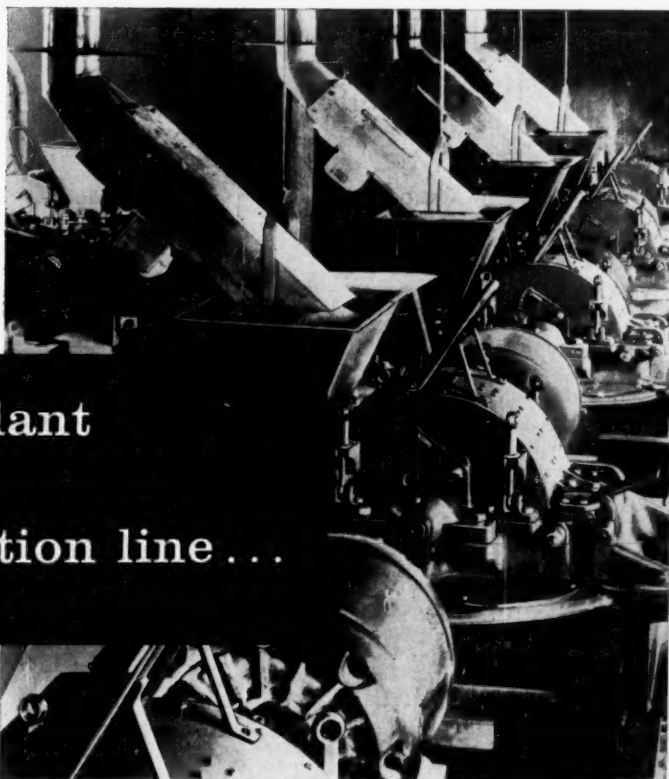
"It would seem," he said, "that our best insurance against an all-out atomic war is an offense capability which could put the 'self preservation' of our potential enemies in great jeopardy.

"Naturally, at the same time we need to develop a defense potential, if we can, capable of softening any atomic attack. But, the only sure defense against an atom attack is to avoid it altogether.

"Assuming that two strong powers have these same objectives, the outlook is merely for an armed truce."

► **Kirkpatrick MC's** — Dr. Jef-

A Battery of No. 4TH Mikro-Pulverizers . . . 50 hp. motors . . . capacities to 25,000 lbs. per hour.



pilot plant
to
production line . . .

The Bantam Pulverizer — a complete miniature grinding mill with $\frac{3}{4}$ or 1 hp. motor. Bulletin #51A

There's A MIKRO-PULVERIZER For Every Grinding Job!

Throughout the processing industries—wherever materials are ground to exacting specifications—Mikro-Pulverizers are at work. Among these units are miniature mills for product development . . . ultra-high capacity mills producing more than ten tons per hour . . . or any of a complete range of intermediate sizes. Each unit is adaptable to a wide variety of special conditions and requirements, to produce the best results possible on specific applications.

In addition, the quality and fineness of grind specified for your product can be exactly duplicated on any Mikro-Pulverizer, allowing you to predict results in advance.

Let us show you what you can expect from a Mikro-Pulverizer. Send us a sample of your product. *We'll grind it at no cost to you* . . . and make recommendations that can put more profit in your production.

GENUINE MIKRO-D REPLACEMENT PARTS AVAILABLE FROM LARGE STOCK WITHIN 48 HOURS.

Mikro-D

PULVERIZING MACHINERY DIVISION

METALS DISINTEGRATING COMPANY, INC.

55 Chatham Rd.

Summit, N. J.

MANUFACTURERS OF PULVERIZING, AND CRUSHING AND SORT COLLECTION EQUIPMENT

fries, according to toastmaster Sid Kirkpatrick's introductory remarks, "played a prominent part in the atomic bomb project, working with Arthur Compton and Enrico Fermi in the so-called 'metallurgical' laboratory at the University of Chicago. Because he was the first to suggest its name, he is widely credited as the godfather of the nucleonics industry.

"In his long association with the General Electric Co., he was first technical director of its lamp department. Then, later he rose to president and board chairman of the Carboly Co. From 1945 to 1949, he was vice president in charge of all of GE's chemical and metallurgical operations at Pittsfield, Mass."

Currently, Dr. Jeffries is chairman of the board of Battelle Memorial Institute and vice chairman of the Minerals and Metals Advisory Committee of the National Academy of Science, having long served on its research and development boards for ordnance and for the national defense.

► **First Individuals Honored** — Surprise of the evening was four special awards—the first personal awards ever given for chemical engineering achievement. They went to:

John Van Nostrand Dorr, chairman of the board, Dorr-Oliver, Inc., whose classifier, agitator and thickener, "that came out of extractive metallurgy is known the world over in chemical as well as metallurgical engineering."

Antoine M. Gaudin, Richards professor of mineral dressing, MIT, "for his brilliant work with AEC and other governmental agencies concerned with extractive metallurgy of the Atomic Age."

Wilhelm Hirschkind, technical advisor to the president, Dow Chemical Co., "personally directed . . . successful application of both ion-exchange and solvent extraction techniques to recovery of atomic-age metals from their ores."

Frank Breyer, chairman of the board, Singmaster & Breyer, "world-wide reputation as a metallurgical and chemical engineer . . . most helpful to CE Achievement Award Committee."

Udy Ferromanganese Gets Commercial Nod

Marvin Udy's new electric-furnace method for winning ferromanganese from plentiful low-grade ore (*Chem. Eng.*, April 1957, p. 166) is well on the way to commercial acceptance, with a duo of plants in the offing.

Strategic-Udy's prototype plant at Niagara Falls has completed runs on low-grade manganese ore with gratifying results. It termed the process an "economic as well as technical success."

Process features novel smelting technique. Electric-arc furnaces couple short arc with careful feeding to give optimized heating effect.

Strategic has joined with Koppers Co. for commercializing the process. Koppers is developing engineering design and cost estimates for a full-scale plant to exploit Strategic's manganese ore deposits in New Brunswick.

Strategic will also team with Koppers investigating a new application for Udy process—winning of ingot iron from laterite ore. Niagara Falls prototype unit is being converted to make the laterite test runs.

Too, Strategic has formed a new company with Gunnar Mines called Strannar Mines Ltd. New company will use Udy process on chromite ore owned by Gunnar, will produce ferrochrome and other chrome products.

More Rutile Coming From Domestic Mines

Domestic rutile (high-grade titanium ore) shows signs of cutting into the virtual monopoly that Australia has enjoyed in the U. S. market. Latest U. S. producer is Metal & Thermit Corp., which recently opened a \$1.3-million mine and processing plant for rutile and ilmenite ores.

Located in Hanover County, Va., capacity of this new plant is 100 tons/hr. of rutile ore. Adjacent mine site covers 800 acres. It's expected that this mine alone will supply 12% of U. S. rutile consumption in 1958.

Currently, 70% of U. S. consumption—used mainly in titanium production and in coatings

for arc welding electrodes—is supplied by Australia. Virginia is now the third state producing rutile. Previously Florida and South Carolina were only other domestic sources.

Convention Calendar

Combustion Institute, Provisional Western States Section, winter meeting, California Institute of Technology, Pasadena, Calif., Jan. 20.

Compressed Gas Assn., 45th annual meeting, Waldorf-Astoria Hotel, New York, N. Y., Jan. 20-21.

Ninth Plant Maintenance & Engineering Conference, concurrently with Plant Maintenance & Engineering Show, Hotel Palmer House and International Amphitheater, Chicago, Ill., Jan. 27-30.

Canadian Pulp & Paper Assn., Technical Section, annual meeting, Sheraton-Mt. Royal Hotel, Montreal, Que., Jan. 29-31.

Instrument Society of America, symposium on chemical and petroleum instrumentation, Hotel DuPont, Wilmington, Del., Feb. 3-4.

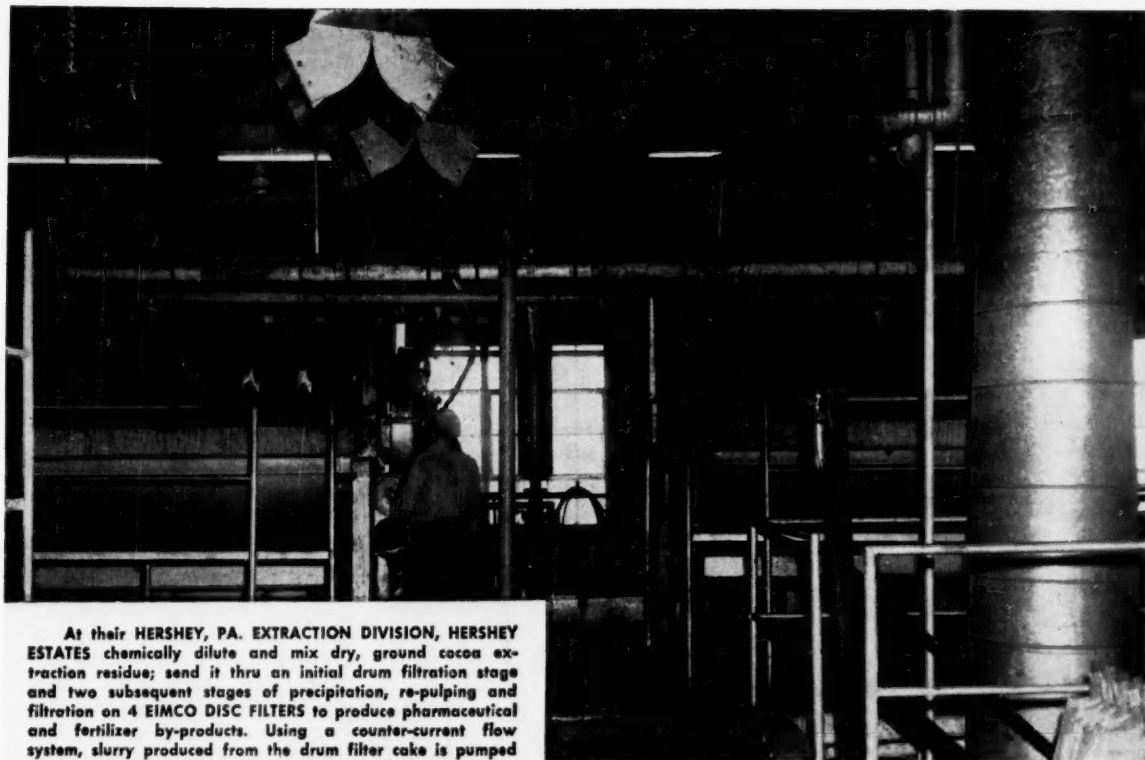
Society of the Plastics Industry, 13th Reinforced Plastics Div. Conference, Edgewater Beach Hotel, Chicago, Ill., Feb. 4-6.

Instrumentation and Control in the Process Industries Conference, sponsored by Armour Research Foundation, Hotel Sherman, Chicago, Ill., Feb. 6-7.

American Society for Testing Materials, annual meeting, Hotel Statler, Boston, Mass., Feb. 10-14.

American Society for Engineering Education, 1958 College Industry Conference, University of Michigan, Ann Arbor, Mich., Jan. 30-31.

National Society of Professional Engineers, spring meeting, Michigan State University, East Lansing, Mich., Feb. 13-15.



At their **HERSHEY, PA. EXTRACTION DIVISION, HERSHEY ESTATES** chemically dilute and mix dry, ground cocoa extraction residue; send it thru an initial drum filtration stage and two subsequent stages of precipitation, re-pulping and filtration on 4 **EIMCO DISC FILTERS** to produce pharmaceutical and fertilizer by-products. Using a counter-current flow system, slurry produced from the drum filter cake is pumped to Eimco Filter Station No. 1 (large photo). Final precipitation is gravity fed to Eimco Filter Station No. 2 (directly below), and the end-product is transported to storage on a continuous belt conveyor. Bottom photo shows closeup of Eimco Disc cake formation.

EIMCO FILTERS - SERVICE WIN HERSHEY'S CONFIDENCE

HERSHEY, PA. - Client confidence in Eimco filter equipment and service over a period of 15 years, is expressed by **Mr. H. B. Brewer**, operating manager of the **Extraction Division, Hershey Estates**.

In 1941, it became feasible to add a two stage precipitation, re-pulping and disc filtration process to the flowsheet producing by-products from dry, ground cocoa extraction residue.

Mr. Brewer describes operation of two disc filter stations subsequently designed and installed by Eimco, "highly satisfactory. Over a 15 year period of around the clock operation, they have given us a dependable, efficient operation that has increased production and improved product quality."

This performance is a tribute to the durability and high mechanical operating efficiency of **Eimco** equipment and **Hershey's** intelligent maintenance program on a "planned" rather than "emergency" basis. From time to time, **Eimco** engineers and **Hershey** technologists have worked hand in hand to develop improvements to bring plant capacity to its present 90 tons of solids-per-day production.

The skills and experience that have won such lasting client confidence are at your disposal. Write today... there's an Eimco Branch and Engineer in your vicinity.



THE EIMCO CORPORATION

SALT LAKE CITY, UTAH

Research and Development Division, Palatine, Illinois

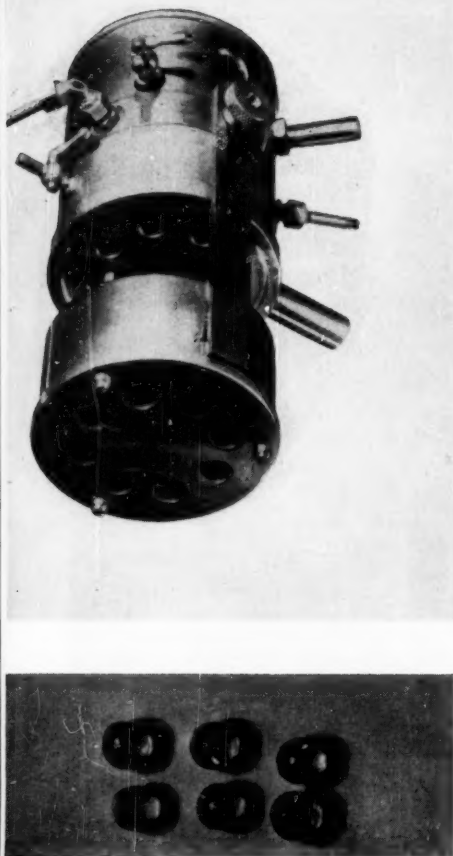
Export Offices: Eimco Building, 51-52 South Street, New York 5, N. Y.

Process Engineers Inc. Division, San Mateo, California

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD



B-288



Pack in Low-Cost Capsules

Profits loom for materials packed in small capsules.
Process encapsulates liquids or solids at low cost.

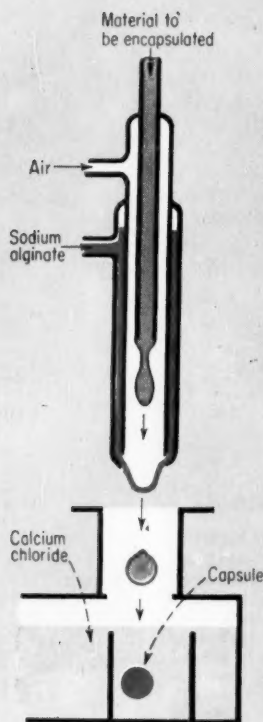
Outstanding simplicity and low cost of a new encapsulating method (U.S. 2,766,478) are claimed to open up this type of packaging for use with low-cost liquids and powders, not miscible with or soluble in water. First used in France, it's now available in U.S. by licensing arrangements.

Until now, capsule packaging has not been economically feasible for such materials. But, with the new Pathus-Labour calcium alginate capsule, they can be marketed in small quantities at a profit. Included are materials such as pharmaceutical products like camphor oil, vitamin oils, turpentine oil and eye washes; household products such as clean-

ing fluids, liquid waxes, shoe polishes and vegetable oils.

► **Some Actual Costs**—A Pathus-Labour installation at Grasse, France, turns out capsules of inexpensive perfume for shipment to Africa at a total production cost of \$6.60/12,000 capsules. Another installation, that of Laboratoire Lyonnaise, Lyons, France, puts cleaning fluid into capsules.

In France, capsule machine costs \$1,200, f.o.b. factory, for an assembled 10-20 nozzle unit (approx. 30 capsules/min./nozzle). Licenses for encapsulating any products but hydrocarbons are available from Mr. J. Pathus-Labour through his U. S. representative, the Council on Public Relations, Inc.,



366 Madison Ave., New York 17, N. Y. For development work on new applications, Mr. Pathus-Labour has arrangements with Southwest Research Institute, San Antonio, Tex.

► **Seaweed Source**—Raw material for the capsule skins is an alginate extracted from certain species of kelp. Capsule shell forms almost instantaneously when sodium alginate solution converts to insoluble calcium alginate on contact with calcium chloride solution.

Material to be encapsulated, say perfume, is introduced through the top of a vertical tube set within a second tube and extending about three fourths of its length. Sodium alginate is supplied through an annular space between the second and a third tube. Across the orifice which terminates tubes two and three, sodium alginate forms a meniscus.

Successive drops of perfume fall from the nozzle of the innermost tube. As each one strikes the sodium alginate meniscus, a slight pneumatic pressure is applied on the inside of the film through the annular space between tubes one and two. Meniscus and perfume fall, the sodium alginate enclosing the perfume in a continuous skin.

Below is the calcium chloride hardening bath. Rapid hardening of the alginate produces a tension which gives to the capsule a substantially spherical shape.

A single nozzle device produces about one capsule per second. A battery of single-nozzle units can be mechanically assembled without difficulty and fed from a single supply source. Or compact multi-nozzle units (see cut) can be built in a wide range.

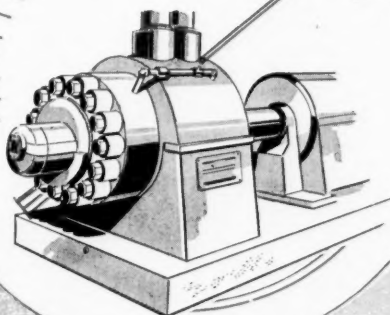
The capsules are soluble in the gastric juices of men and animals. This dissolution is accelerated when albumin is incorporated into the alginate, and may perhaps be regulated.

There is also a possibility of making the capsules soluble in water by addition of sugar or some other substance. On the other hand, water with a substantial salt content seems to disintegrate the calcium alginate.

hi-psi *

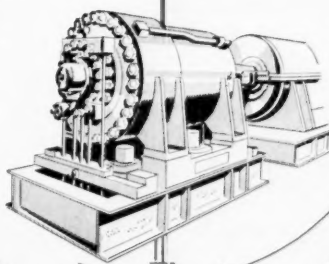
6,500 psi

CENTRIFUGAL PUMPS



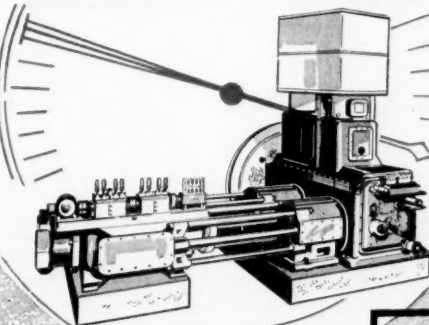
2,200 psi

CENTRIFUGAL COMPRESSORS



35,000 psi

RÉCIPROCATING COMPRESSORS



These gauges show high levels of gas and liquid pressures created by machines designed and built by Ingersoll-Rand.

Such pressures have not always been practical. Most top levels have crept up little by little as new processes in industry demanded higher and still higher pressures. Those indicated here are bold advances, much higher than the preceding highs. Each is another building block in the foundation of experience.

Through a half century of such experience Ingersoll-Rand has been closely associated with the process and petrochemical industries. If you need to compress a gas, or pump a liquid at any pressure you choose to call high, take advantage of Ingersoll-Rand's experience that has continuously set the pace in high-pressures.



Ingersoll-Rand

1-681

11 Broadway, New York 4, N. Y.

* hi-psi . . . high pressures,
measured in pounds per square inch.

The Southwest Research Institute has proposed to investigate these various potentialities.

► **How Big?**—Diameter of capsules can be varied between 3/16 and 9/16 in. In a given case, possible limits depend primarily on the specific gravity of the material. Another factor is the resistance and elasticity of the alginate meniscus at the end of the nozzles.

Generally, thickness of the capsule skin depends on diameter; small capsule has thicker skin. However, to a certain extent, skin thickness can be regulated by modifying the size of the annular nozzle opening. It will run from about 0.4 to 0.8 mil.

Portable Oxygen Plants Will Aid Missile Mobility

Air Products, Inc., working with the Army Engineers, has developed a mobile liquid oxygen plant—a real boon for missile fueling at far-flung bases. Using two readily available raw materials—air and diesel fuel—new portable unit produces LOX at -297 F., requires no extra chemicals or cooling water.

Entire LOX plant is contained in four semi-trailers and can be set up anywhere in a few hours. Capacity of this portable plant is about 20 tons/day of 99.5% oxygen. Yield is around two pounds of LOX per pound of diesel fuel.

► **Flowsheet on Wheels**—Two of the trailer units are identical. Each carries a 1,200-hp. air-

cooled diesel engine and a rotary compressor which takes air from the atmosphere and compresses it to 100 psi.

Compressed air is fed to a third trailer containing a heat-exchange system. Air is cooled by cold nitrogen gas recycling from further process stages. Water vapor, carbon dioxide and other impurities are frozen out.

System is piped so that periodically a blast of nitrogen ejects deposited impurities. Emerging from this unit, air is chilled to near-liquid state.

► **From Truck to Rocket**—Fourth trailer further chills air by heat exchange with cold nitrogen and then the chilled air is flashed, partly liquifying. Liquid air is separated from gaseous portion in a centrifugal separator, then subcooled and passed to a distillation column. Cold gaseous air is reprocessed.

Nitrogen gas is stripped out of the liquid in the column and recycled to heat exchangers. Product LOX is piped to special storage tanks prior to fueling.

New Route for Vanillin From Pulp Sulfite Liquor

A West German firm, Aschaffenburg Zellstoffwerke, of Aschaffenburg, has developed an improved process for making vanillin from waste sulfite liquor in pulp or cellulose production.

Key step in the process is neutralizing alkaline sulfite liquor with waste carbon dioxide and mixed sodium, potassium and magnesium chlorides, then oxi-

dizing with air under pressure. Neutralizing procedure precipitates lignin derivatives (mainly aromatic alcohols and terpenes) which would hinder extraction of vanillin in neutral solution. Following air oxidation, vanillin is extracted from neutral solution by ion exchange and purified with steam distillation.

New process yields roughly 18.2% vanillin, based on lignin content.

News Briefs

Coal chemicals: Jones & Laughlin is now turning out high-purity aromatics (sulfur content less than 1 ppm.) at its new \$2-million refining plant at Aliquippa, Pa. Using Hydrofining and Udex extraction, the plant processes light oil from coke-oven gas to get 55,000 gal./day of aromatics—about 70% benzene, 20% toluene and 10% xylenes.

Thermionic converter: General Electric physicist Volney Wilson has now converted heat directly to electricity at relatively high efficiencies: over 8%, contrasted with less than 1% for thermocouples. Wilson's converter: Two molybdenum electrodes maintained at high, but different, temperatures (2,500 F. and 1,250 F.) in a glass tube containing a gas at low pressure. The gas, says Wilson, must contain positive ions. Electrons boiled out of the cathode are collected on the anode.

Volume 65—Chemical Engineering—Number 1

Chemical Engineering, with which is incorporated *Chemical & Metallurgical Engineering*, is the successor to *Metalurgical & Chemical Engineering*, which in turn was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine*.

The magazine was originally founded as *Electrochemical Industry*, in September 1902, and was published monthly under the editorial direction of Dr. E. F. Roeber. It continued under that title until January 1905 when it was changed to *Electrochemical & Metallurgical Industry*. In July 1906 the consolidation was made with *Iron & Steel Magazine* which had been founded eight years previously by Dr. Albert Sauveur. In January 1910 the title was changed to *Metalurgical & Chemical Engineering*, and semi-monthly publication was begun Sept. 1,

1915. On July 1, 1918, the title was changed to *Chemical & Metallurgical Engineering* and weekly publication was begun Oct. 1, 1919. Monthly publication was resumed in March 1925.

In August 1946 the words "*& Metallurgical*" were dropped from the main title to bring its name more in keeping with the editorial content.

Starting with this first 1958 issue, *Chemical Engineering* is to be published biweekly.

Dr. E. F. Roeber was editor of the paper from the time it was founded until his death Oct. 17, 1917. After a brief interim he was succeeded by H. C. Parmelee. Ten years later, Nov. 1, 1928, Dr. Parmelee assumed other responsibilities in the McGraw-Hill Publishing Company and Sidney D. Kirkpatrick was appointed editor.

Dr. Kirkpatrick was named editorial director July 1, 1949, and at that time he was succeeded as editor in chief by John R. Callahan.

The present editorial staff is, in addition to Dr. Kirkpatrick and Mr. Callahan: Cecil H. Chilton, editor (developments); Theodore B. Olive, editor (practice); Lester B. Pope, editor (presentation & production); C. S. Cronan, R. F. Fremed, R. B. Norden, D. R. Cannon, associate editors; F. Arne, T. E. Arnold, J. B. Bacon, S. Danatos, T. P. Forbath, M. A. Gibbons, M. D. Robbins, M. R. Wenk, assistant editors. Editorial regional representatives are: J. A. Lee, Houston; Emil Mikity, San Francisco.

[All rights to above magazine titles reserved by McGraw-Hill Publishing Co., 330 West 42 St., New York 36, N. Y.]

BETTER PIPELINE STRAINERS

... BY YARWAY

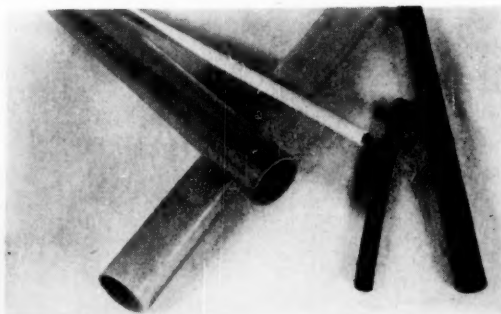
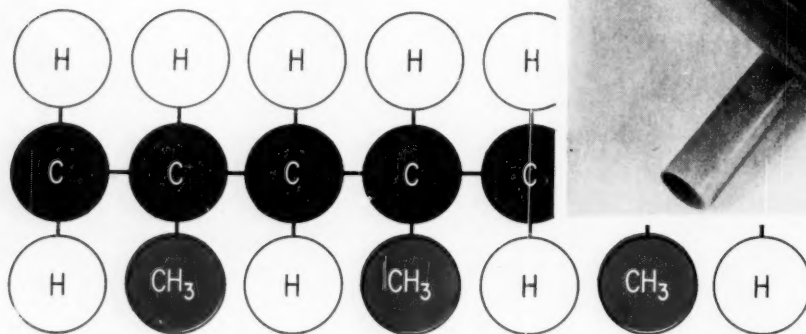


Here's why your best strainer buy is Yarway:

- **Screens** of Dutch-weave Monel wire filter cloth for maximum straining service and minimum flow restriction. Great mechanical strength. Perforated screens also available.
- **Screen caps** easy to remove when cleaning or replacing screens. Straight threads, machined faces, spark-plug type gasket.
- **Body** has rust-resistant finish.
- **Wide range of sizes and pressures**—
Screwed end, to 600 lbs. pressure.
Iron and steel, $\frac{1}{4}$ " to 3". Bronze, $\frac{1}{4}$ " to 2".
Flanged end, to 600 lbs. pressure.
Iron, bronze, steel, $\frac{1}{2}$ " to 5".
Socket weld ends, to 1500 lbs. pressure.
Steel, $\frac{1}{2}$ " to 3".
- **Available from 275 Industrial Distributors.**
Write for Bulletin S-205.

YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY... a good way to specify strainers



Isotactic Polypropylene Arrives Here

Resistant to 300 F., isotactic polypropylene is a candidate for hot water plastic pipe. Heat resistance is due to an unusual regularity of structure called isotactic.

A radically new thermoplastic, polypropylene, has been put on the U.S. market by Italy's Montecatini. Made from petroleum byproduct, propylene gas, it is said to be the lightest plastic material ever produced, one of the most heat-resistant thermoplastics, with excellent dielectric properties even at high frequencies. It has excellent resistance to grease and oil, water, resistance to many common acids, high impact strength.

Controlled crystallinity in the plastic is the key to this unusual combination of properties. Called Moplen, it is based on research by Guilo Natta of Italy on a new polymerization method (see p. 143).

Method makes it possible to obtain linear macromolecules with a spatially ordered "isotactic" structure. Regular polymerized polypropylene has been known in the laboratory for years but is not isotactic and is not highly crystalline.

Eventually, polypropylene will probably be as cheap or cheaper than polyethylene. As yet, producer Montecatini has no price schedule for this country but has been selling its polypropylene in Italy for about 50¢/lb.

The company recently bought land in Huntington, W. Va., near Ashland Oil Co.'s refinery, a potential propylene source. However, report is that it's too early for a decision to build a polypropylene plant. In Italy, company has ordered units which will quadruple its raw material olefin production.

Isotactic polypropylene can be molded easily in the same molds now used for conventional polyethylene—even the largest. It is claimed to have a 10% higher heat resistance than high density polyethylene, with a harder surface warp resistance and a better gloss.

Montecatini has stated that Moplen resists 300 F. and sug-

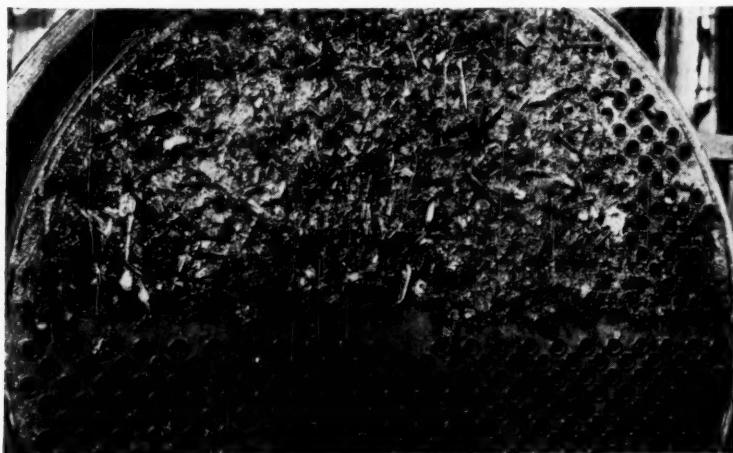
gests possibilities for hot water plastic pipe. To get some idea of its potential suitability for this application relative to that of low-pressure polyethylene: Phillips states only that bottles made of its Marlex 50 can be sterilized in heat to 250 F.; Allied says that its A-C low pressure polyethylene pipe resin resists boiling water (212 F.) under low pressure.

Films and fibers have been produced from the resin in addition to a large number of molded products. The films show good clarity, are said to be strong and possess excellent dielectric properties. Although molded applications in some instances are expected to overlap with formulations of polyethylene and high impact styrene, the material is said to be more flexible and thus particularly suited to the fiber field. It can be blended with wool, cotton and synthetics. An elastomeric polypropylene may well be the next development to look for from Montecatini. Natta has showed that it's possible to tailor a molecule to give it elastomeric properties.—Chemore Corp., 21 West St., New York, N. Y.

BRIDGEPORT BRASS

COPPER ALLOY BULLETIN

CONDENSER AND HEAT EXCHANGER TUBE EDITION



Inlet end of first pass of heat exchanger blocked by trash.

Cleaning Methods that Insure Longer Tube Life and Greater Operating Efficiency

The high cost of foreign matter in condenser tubes is all too well known. Slime, marine organisms, silt, cinders and trash—all create the common costly problems of decelerated heat transfer and accelerated corrosion.

An effective tube-cleaning program is of prime importance in helping to keep operating costs at economical levels. As with all conditions of heat exchanger and condenser tube operation, cleaning methods vary in virtually each situation, depending, of course, on the nature of contamination.

In some applications rubber plugs are found to be effective. Brushes and scrapers, too, shot through the tubes by compressed air or water can clear lodged debris. Sometimes, these methods are not wholly satisfactory; the presence of stubborn debris may call for "rodding." Maintaining strainers and using rotating or stationary screens are preventive maintenance aids that pay dividends.

Scale Removal

The use of acids or strong alkaline solutions, which are inhibited to reduce corrosion of the tubes, can often dissolve or loosen scale or slime on the tube walls. Here, again specifics must be known before the correct cleaning solution can be formulated to effectively solve the problem. Very important is the alloy itself; full familiarity with its chemical make-up is essential so that the cleaning solution attacks only the scale and not the metal.

Slime Prevention

A properly set-up schedule of chlorination is highly effective against the formation of slime on tube walls. Water characteristics must be taken into account before the correct concentration of chlorine in the water can be arrived at. Over-chlorination can result in accelerated corrosion by rupturing the protective film on the tube surface. When the chlorination procedure is satisfactory, a red-brown or amber-colored film forms on the tube surface. Slime decomposition also can lead to the formation of ammonia, particularly during shutdown or stand-by, which may initiate stress corrosion-cracking of copper alloys with a high zinc content.

Biofouling

Biofouling organisms should be promptly removed from the tube surface by persistent scrubbing with a stiff brush and water. When these organisms die and dry on the tube surface it is doubly difficult to remove them, especially those with calcareous bases such as barnacles. When allowed to remain, the decomposition products of these organisms destroy the corrosion film and thus

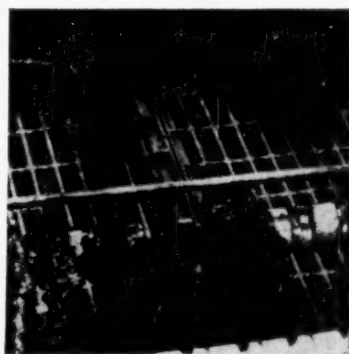


Biofouling in unchlorinated sea water.

create a focal point for corrosion pitting. Increasing water velocity, when feasible, prevents the organisms from getting a fast hold, and is often helpful in reducing tube corrosion and maintaining heat transfer.

Bridgeport Technical Service

You can always get help on your cleaning problems from Bridgeport Technical Service. Our familiarity with heat exchanger and condenser tube operation—under all conditions of contamination, both at sea and ashore—can help in analyzing your specific cleaning problem and result in a cleaning procedure that will help your tubes "live longer." For any information on the subject of tube hygiene, write or call the Bridgeport Sales Office nearest you.

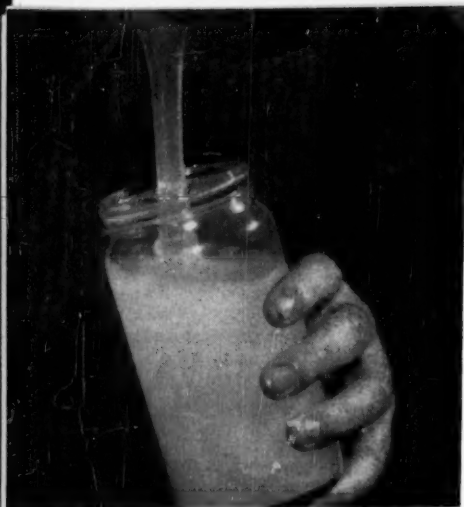


Control of biofouling by chlorination of sea water.



BRIDGEPORT BRASS

Bridgeport Brass Company, Bridgeport 2, Conn. • Sales Offices in Principal Cities
In Canada: Noranda Copper and Brass Limited, Montreal



High Polymer

Water-soluble resins formed by linking up to 100,000 ethylene oxides.

Polyox water-soluble resins are a new group of exceptionally high molecular weight polymers of ethylene oxide. Dissolved in water at low concentrations, photo above, they have greater thickening power than any material now commercially available. They resist biological attack, oils and greases, have low moisture pickup in dry form, are compatible with other types of polymers such as starch and polyvinyl acetate.

Suggested applications for these new resins include: textile warp sizes; paper coatings; detergents; aerosol hair sprays; toothpastes; water-soluble packaging film; and adhesives.

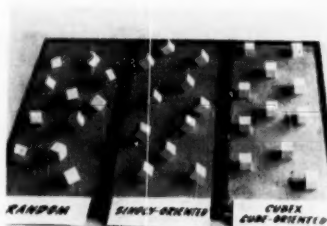
Five grades of Polyox resins representing a range of molecular weights are now available in pilot plant development quantities. Substantial commercial-scale production is scheduled for early 1958, and a large commercial unit is planned for 1960. Initial cost of the resins will be \$1.50/lb. Eventually, the cost is expected to drop to the 75¢ range, with an ultimate potential of 35¢. These prices are for three grades; the top viscosity resin will be available shortly at slightly higher cost. A textile grade for sizing cotton is now 75¢.

Polyox resins, formed by linking as many as 100,000 ethylene oxide units, are characterized by a high degree of crystallinity and a combination of thermoplastic properties unusual for

a water-soluble resin. They can be processed by calendering, extrusion and injection molding. Films or sheets can be readily heat-sealed. Plasticizers increase the flexibility and extensibility of the resins.

In water solutions, they show almost no surface activity. Solutions of higher viscosity grades exhibit a definite stringiness. They are soluble in organic solvents such as acetonitrile, methylene chloride and ethylene dichloride. They do not adhere to most common surfaces; hence they are suitable as mold release agents. Where good adhesion is desired, blend with minor amounts of dimethyl hydantoin-formaldehyde resin.

Possibilities of hazards in using Polyox seem to be remote. Standard two-year toxicological feeding tests are not completed, but preliminary data indicate low toxicity. — **Union Carbide Chemicals Co., 30 East 42nd St., New York, N. Y.** 94A



Magnetic Steel

From tidiest crystal pattern, 4-way magnetic steel.

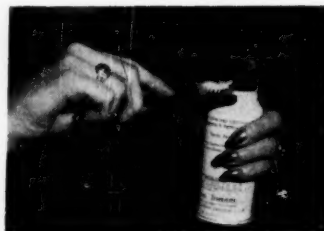
Small wooden blocks, representing the cubes of silicon-iron crystals in a sheet of steel show why Cubex, a new electrical steel (*Chem. Eng.*, Dec. 1957, p. 142), has such excellent magnetic characteristics.

The direction along any edge of the cube represents an easy path for magnetization; directions across any face of the cube, or diagonally through it, represent difficult paths. When, as in Cubex, each cube rests flat on one side and squarely faces the ends and sides of the tray, good magnetic paths exist along both the width and length of the sheet.

In contrast, the crystals in ordinary singly-oriented silicon-

iron are so arranged that only the lengthwise path exists. In randomly oriented steel, the number of easy paths is guesswork.

Cubex is a product of joint research of Siemens-Halske Vakuumschmelze, Hanau, Germany, and Westinghouse. — **Westinghouse Research Laboratories, Pittsburgh, Pa.** 94B



N₂-Propelled Aerosols

New nitrogen propellants usher in push-button toothpaste.

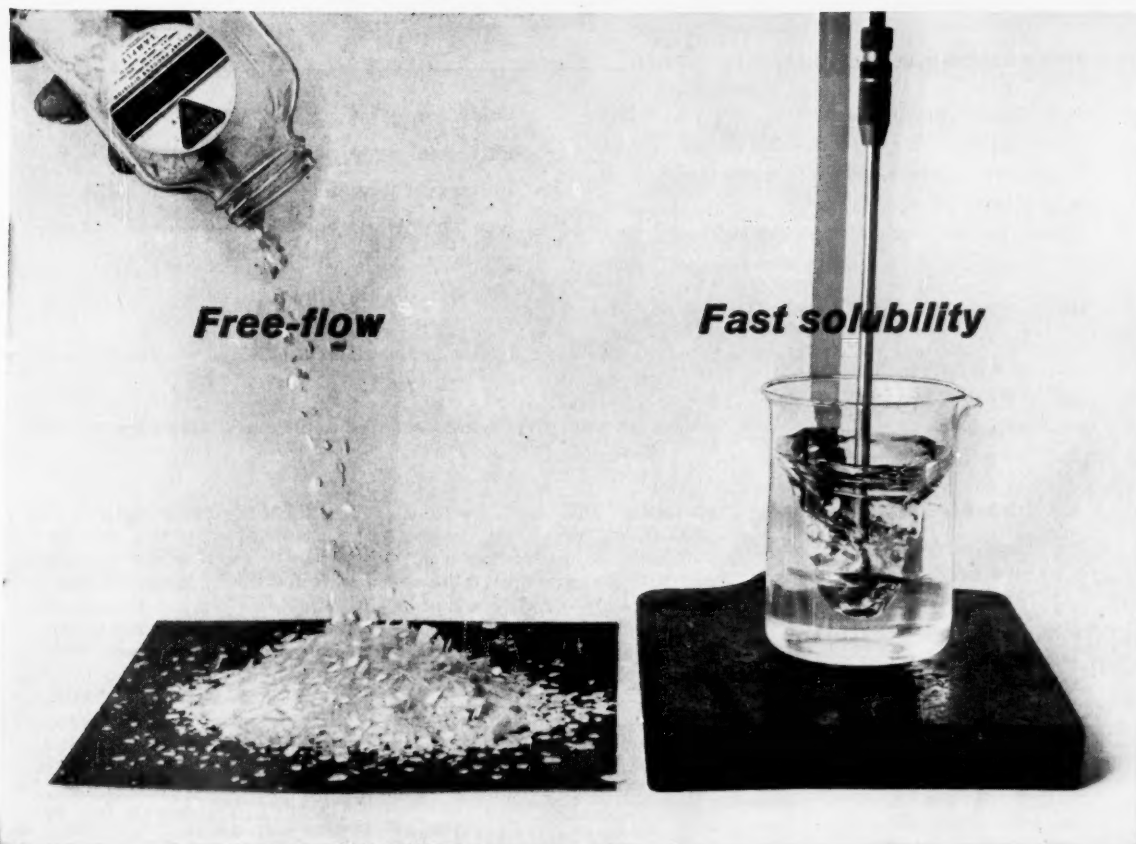
Nitrogen-propelled aerosols, produced for the first time, are said to make many new products available to the pressure packaging marketer. First such products will be a push-button toothpaste, cleansing cream and hair dressing. And a line of food condiments and syrups is now being tested.

In all of these cases, it is desirable that the products emerge in exactly the form in which they're contained in the can. Thanks to the inertness of nitrogen, which acts like an invisible internal piston, delivery of product without physical disturbance by the gas is assured.

In contrast, conventional aerosol products like whipped cream or shaving cream are best used as a froth. This consistency is the natural result of using conventional fluorinated chlorinated hydrocarbon propellants, which mix with and froth the product as it emerges from the can.

The new propellant is said to be much less expensive than these conventional propellants.

Nitrogen-propelled aerosols are a joint development of the manufacturer and its valve supplier. — **Aerosol Techniques, Inc., Silliman Ave., Bridgeport, Conn.** 94C



...both yours in the **NEW FLAKE** form of **SOLVAY ANHYDROUS U.S.P. SODIUM NITRITE**


Now—anhydrous U.S.P. sodium nitrite in SOLVAY's exclusive new *flake* form...designed to give you free-flow without substantially sacrificing rate of solubility. If you are looking for sodium nitrite that will store without caking and yet dissolve rapidly—be sure to specify Solvay *FLAKE* Sodium Nitrite. This time and labor saver costs you no more! Packed in 400-lb. fiber drums, 100- and 400-lb. steel drums, 100-lb. bags to meet your individual needs.

Sodium Nitrite • Caustic Soda • Calcium Chloride
Chlorine • Caustic Potash • Potassium Carbonate
Sodium Bicarbonate • Chloroform • Vinyl Chloride
Methyl Chloride • Ammonium Chloride • Methylene
Chloride • Cleaning Compounds • Hydrogen Peroxide
Ammonium Bicarbonate • Aluminum Chloride • Carbon
Tetrachloride • Monochlorobenzene • Para-dichlorobenzene
Ortho-dichlorobenzene • Soda Ash • Snowflake® Crystals

SOLVAY branch offices and dealers are located in major cities from coast to coast.



Mail coupon for sample!

	SOLVAY PROCESS DIVISION ALLIED CHEMICAL & DYE CORPORATION 61 Broadway, New York 6, N. Y.	
	Please send me without obligation: <input type="checkbox"/> Inspection sample of SOLVAY flake Sodium Nitrite. <input type="checkbox"/> Prices and name of my nearest dealer.	
Name _____		
Position _____		
Company _____		
Phone _____		
Address _____		
City _____	Zone _____	State _____

DR-1

News-worthy chemicals this month

Isotactic polypropylene here.....92A
 New high mol. wt., water soluble resins....94A
 Magnetism goes four ways in new steel....94B
 N₂-propelled aerosols94C
 Unusual chemistry makes insecticide safer.96A
 PVAc-based paints no longer water spot...96B

Reinforced plastic fights high heats.....96C
 Polyacetal resin complements nylon.....96D
 Boron fuel for jets goes commercial.....96E
 New and better diuretic.....96F
 Flat borosilicate glass resists 900 F.....96G

Page number is also Reader Service code number

For more about any item, use the Reader Service Card

Carbamate Insecticide

Departs from conventional insecticide chemistry to get safety, strength.

Tests to date indicate that a new insecticide, an aryl urethane tradenamed Sevin, controls a wide variety of insects and will rank as one of the safer products for humans to handle.

One of the few synthetic organic insecticides that contain neither chlorine nor phosphorus, and in no way similar to such established insecticides as arsenicals and fluorides, it is known chemically as 1-naphthyl N-methylcarbamate.

Carbide entomologists who worked on Sevin's development found it promises outstanding control, particularly of many leaf-feeding beetles and hard-to-kill moth and butterfly worms. Formerly called Compound 7744, the experimental insecticide is now being tested in cooperation with state and federal agricultural experiment station scientists.—Union Carbide Chemicals Co., 30 East 42nd St., New York, N. Y. 96A

Emulsifier-Free PVAc

Freed of emulsifiers, PVAc paint films are free of water-spotting.

With a new method of polymerization called the Q process, vinyl acetate polymers and copolymers can now be manufactured without emulsifiers.

The water sensitivity of these emulsifiers has long presented problems to paint and coating

chemists. Until now, the polymerization of vinyl acetate monomers into useful polymers and copolymers required the addition of substantial amounts of protective colloids or emulsifiers, such as polyvinyl alcohol or hydroxy-ethyl cellulose. When water came in contact with the finished painted surface, emulsifiers would leach out, whitening the film and often leaving a peripheral stain after evaporation.

Q process counterparts will be made available for many of the company's existing vinyl acetate polymers and copolymers. Already in production is copolymer Darex 26980 which parallels the firm's Everflex G. emulsion. —Dewey & Almy Chemical Co., 62 Whittemore Ave., Cambridge, Mass. 96B

BRIEFS

High temperature, light weight material made of reinforced plastic containing laminations of near-pure silica fibers exhibits a three to one superior performance factor over high temperature metal. Called Astrolite, it has a promising future in the rocket and missile fields.—H. I. Thompson Fiber Glass Co., Los Angeles, Calif. 96C

Polyacetal resin, called Delrin, will be made at Parkersburg, W. Va., at a large scale plant now under construction. Among plastics, new product compares most closely to nylon, in foreseeable price and in properties under ordinary conditions. —Du Pont Co., Wilmington, Del. 96D

High energy boron fuel will be produced early this year at a new commercial plant at Lawrence, Kan. Manufacturer is also building and will operate for the Navy a \$38 million plant at Muskogee, Okla., scheduled to start up by the end of the year. Called HiCal, it is expected to power jet planes and missiles "to new peaks of efficiency and performance." —Callery Chemical Co., Pittsburgh, Pa. 96E

New diuretic, extensively tested, has shown superiority in promoting excretion of sodium and chloride from the body, in equal amounts without upsetting the excretion of other electrolytes. Called Diuril, it is 6-chloro-7-sulfamyl-1,2,4-benzothiadiazine-1, 1-dioxide. —Merck Sharp & Dohme Div., Philadelphia, Pa. 96F

Flat borosilicate glass, recently introduced, features high resistance to thermal shock and chemical action, can be used continuously under proper conditions at temperatures approaching 900 F. —Blue Ridge Glass Corp., Kingsport, Tenn. 96G

For More Information . . .

about any item in this department, circle its code number on the

Reader Service

postcard inside the back cover

INDUSTRIAL CHEMICALS



40 Rector Street, New York 6, N. Y.

BRANCH OFFICES:

Atlanta 3, Georgia
Chicago, Illinois
Cleveland 13, Ohio
Columbia, Mo.
Columbia 1, S. C.
Hopewell, Virginia
Indianapolis 20, Ind.
Ironton, Ohio
Kalamazoo, Michigan

Los Angeles 5, Cal.
Memphis, Tenn.
New York 6, N. Y.
Omaha 7, Nebraska
Orange, Texas
Raleigh, N. C.
San Francisco 4, Cal.
St. Louis, Mo.
St. Paul 4, Minn.

AP2-5-5

ANHYDROUS AMMONIA: Commercial & Refrigeration Grades

(NH_3) of the highest purity available from three producing plants . . . backed by production experience from 1890.

AMMONIA LIQUOR:

Ammonium hydroxide (NH_4OH) . . . multiplant production for a wide variety of uses.

AMMONIUM SULPHATE:

(NH_4) $_2\text{SO}_4$ available at Hopewell, Va.

NFS-83 and NFS-50:

Ammonium nitrate-water solutions containing respectively 83% and 50% (NH_4NO_3). Available from three producing plants.

ETHYLENE OXIDE:

A rocket propellant; fumigant, fungicide and sterilant; reactive chemical intermediate for the synthesis of acids, alcohols, alkylanolamines, cyanohydrins, esters, ethers, glycols and halohydrins.

ETHYLENE GLYCOL:

Practically odorless, hygroscopic liquid with many uses.

DIETHYLENE GLYCOL:

Hygroscopic, non-corrosive liquid with many uses.

TRIETHYLENE GLYCOL:

Low volatility, high boiling point liquid with many uses.

ETHANOLAMINES:

Used in virtually every industry, easy to handle, reactive. Triethanolamine available in two grades—commercial and 98%.

FORMALDEHYDE:

Available as 37% Inhibited, 37% Low-Methanol, 45% Low-Methanol, 50% Low-Methanol.

METHANOL:

Synthetic methyl alcohol of 99.85% purity.

NITROGEN TETROXIDE:

N_2O_4 as oxidant for liquid rocket propellants has higher energy than hydrogen peroxide, red or white fuming nitric acids and mixed acid.

SODIUM NITRATE:

A white crystalline salt of high purity containing a minimum of 99.5% NaNO_3 . Supplied in three grades at no extra cost—coarse, medium and fine crystal sizes to meet exacting process requirements.

UREA:

A white, crystalline solid, Crystal Urea (Carbamide) is a high-purity product made to meet rigid specifications. It is used in an extremely wide range of products and processes.

U-F CONCENTRATE-85:

A specially formulated low-water content, highly concentrated solution especially suited to manufacture of urea-formaldehyde resins and adhesives. Contains 59% formaldehyde, 26% urea.

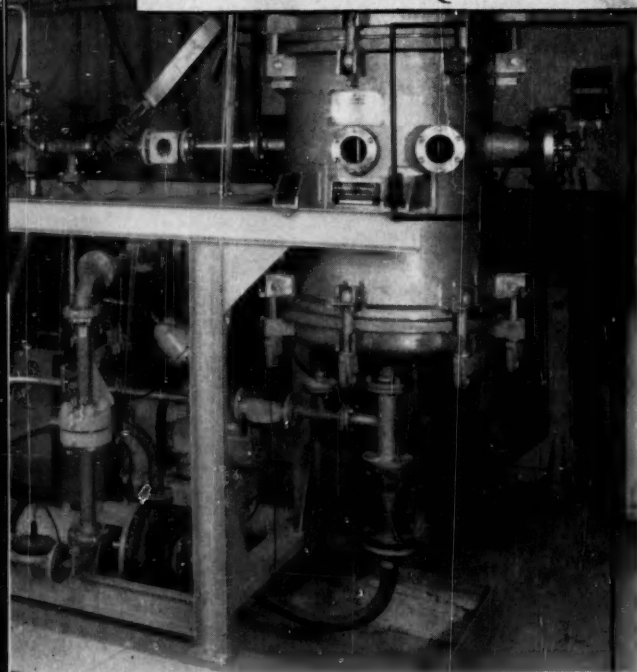
NITROGEN DIVISION

products are the result of more than 60 years of experience. They are backed by high standards of quality, enterprising research, technical assistance and prompt service. We welcome inquiries about any of these products or derivatives of them.

DEVELOPMENTS ...

PROCESS EQUIPMENT

EDITED BY C. S. CRONAN



Cake Indicator Automates Filter

**Indicator checks cake thickness,
stops filtration, starts discharge.**

For the first time, cake thickness is an active factor in controlling the operation of leaf pressure filters. When cake reaches a pre-determined thickness in the latest Durco-Enzinger filter, an indicator warns the operator or triggers the next step in the filtration cycle.

No longer does operator need to rely exclusively on pressure rise or elapsed time to tell him when filter is full of cake. Now, the Durco-Enzinger indicator tells him when the cake has reached a definite thickness.

By teaming the cake-thickness indicator with elements which sense flow, pressure and clarity, Durco-Enzinger engineers can automate their filter to make it completely responsive to its operating variables and eliminate direct operator control.

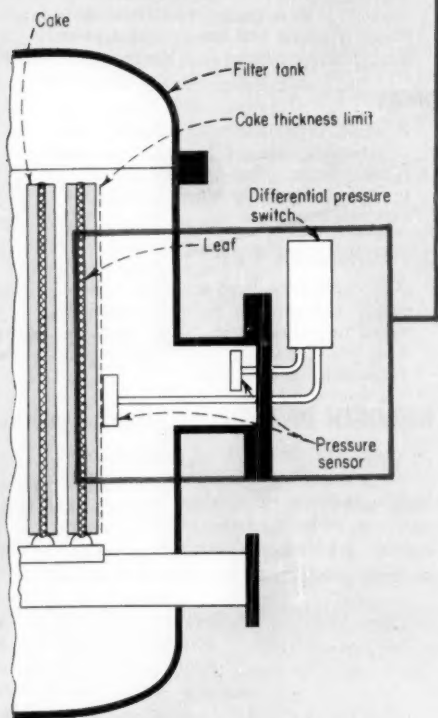
► **No More Broken Leaves**—Through positive monitoring of cake thickness, the Durco-Enzinger filter eliminates completely the age-old danger of bridging the leaves with cake and damaging costly filter elements. Even though solids content in feed to the filter varies widely, the thickness indicator will always know when cake reaches the allowable thickness, no matter how much time has elapsed.

► **More for Dollar** — In addition to offering smoother, more reliable operation, Durco-Enzinger's cake thickness indicator boosts productivity per dollar invested, improves product quality, reduces operating costs.

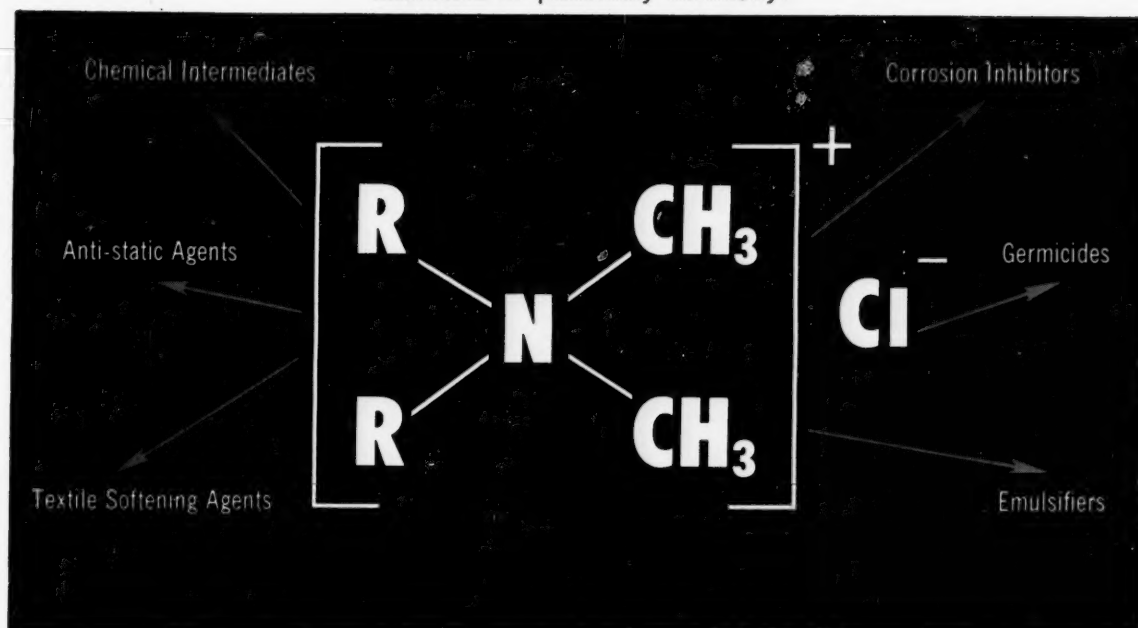
Normally, sales engineers size leaf pressure filters with a large safety factor. That allows filter to hold unexpected surges of solids without damaging the leaves. However, the operator pays a cost penalty for this safety factor.

With positive control over cake thickness, filters can be sized much smaller to eliminate this cost penalty altogether. A job that formerly required an 800-sq.-ft. filter might be done with a 200-sq.-ft. unit fitted with the Durco-Enzinger cake thickness indicator.

Even with all the automatic controls, the smaller unit will be somewhat less expensive.



interested in quaternary chemistry?



who knows what men with ideas will do with General Mills **fatty quaternary ammonium chlorides**

Some of the better known, common industrial uses for General Mills fatty quaternary ammonium chlorides—our trade name, *Aliquats*—are listed above. *Creative chemists are continuing to look for new uses.* Unique characteristics of these cationic chemicals suggest many applications—one or more of which you may be able to use profitably in your operations!

General Mills fatty quaternaries have strong cationic surface activity. They are stable in both acidic and alkaline media and exhibit excellent anti-static and germicide properties.

Aliquats contain the polar nitrogen grouping and long, non-polar hydrocarbon chains. The cationic nature of the Aliquats effects their adsorption on a variety of surfaces, thus imparting a hydrophobic film of superior integrity on the surface of the material thus treated.

Fatty quaternaries are always “on tap” from General Mills, basic producer of fatty acids. Enlarged plant facilities enable us to give even faster delivery of uniform, quality quaternaries.

SPECIFICATIONS

Product	Trade Name	% Quaternary Ammonia Compound	% Sodium Chloride	pH
Lauryl trimethyl ammonium chloride	Aliquat 4	48-52	1.0 max.	9 max.
Palmityltrimethyl ammonium chloride	Aliquat 6	48-52	1.0 max.	9 max.
Coco trimethyl ammonium chloride	Aliquat 21	48-52	1.0 max.	9 max.
Monotallow trimethyl ammonium chloride	Aliquat 26	48-52	1.0 max.	9 max.
Dicoco dimethyl ammonium chloride	Aliquat 221	73-77	0.5 max.	9 max.
Dihydrogenated tallow dimethyl ammonium chloride	Aliquat H226	73-77	0.5 max.	9 max.
1:1 mixture Aliquats 26 and 221	Aliquat 400	48-52	1.0 max.	9 max.

FOR MORE INFORMATION, write

CHEMICAL DIVISION

KANKAKEE, ILLINOIS



District Offices: New York, 156 William St. • Chicago, 460 So. N.W. Hy., Park Ridge, Ill.

Producers of: Sterols • Fatty Nitrogens • Versamid Polyamide Resins • Fatty Acids • Methyl Esters of Fatty Acids

And with elimination of direct operator control, operating labor cost drops very appreciably.

► **Broader Field**—While the cake thickness indicator brings a fourth dimension to leaf pressure filtration, the operation is still fundamentally batch. But, its field of application is considerably broader than conventional leaf filtration.

Enzinger's manager and inventor of the cake thickness indicator, Don Stoltenberg, feels that this filter now can compete with continuous rotary vacuum filters on solids that are sufficiently free filtering to deposit a normal leaf cake. Capital investment is considerably less and performance will equal that of the rotary drum vacuum filter.

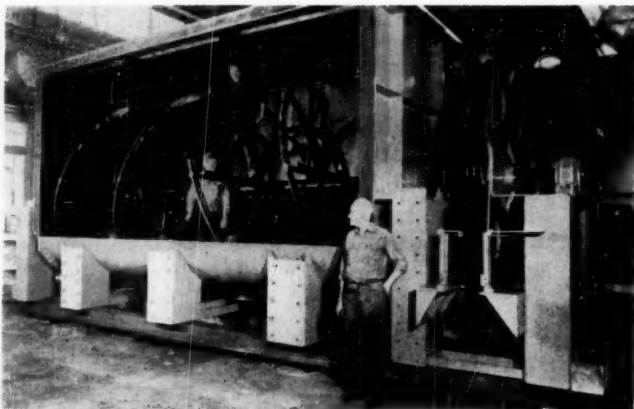
► **Cake Touches Detector**—When filter cake reaches the pre-determined thickness, it covers the face of a pressure-

sensing diaphragm mounted on a tube that extends into the filter tank. Because the diaphragm becomes slightly embedded in the cake, hydraulic pressure on its face is slightly less than tank pressure. Or, in other words, it senses the beginning of hydraulic pressure drop through the filter cake.

Difference between this pressure and that sensed by a similar element exposed to tank pressure actuates a differential pressure switch in the alarm or control circuit.

Enzinger offers the cake thickness indicator as an integral part of new vertical and horizontal leaf pressure filters. Also, the company will install the device on existing Enzinger filters.

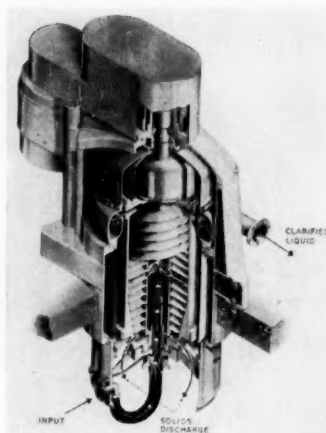
To date, all reports show device is reliable over a wide range of filter cakes, pressures and flows.—Enzinger Div., Duriron Co., Dayton, Ohio. 98A



World's Largest Mixer Blends Carload Batch of Dextrin

Within this one giant mixer, Clinton Corn Processing Co. can blend an entire 60,000-lb. carload of dextrin at a time. Moisture content becomes uniform throughout the batch, eliminating need for the customer to sample extensively to maintain uniform adhesive formulations. Acting through a gear reducer,

and chain and gear drive, a 75-hp. motor drives two, 9-ft.-dia., triple-action, spiral, overlapping ribbon agitators in opposite directions at 10 rpm. Integral scale weighs each batch accurately during filling and discharging to the bagging line.—J. H. Day Co., Cincinnati 12, Ohio. 100A



Pressure Centrifugal

Liquid-solid machine for 250 gpm. at 150 psi.

Devotees of continuous centrifugal machinery have a new conversation piece in Sharples new P-7000 Super-D-Canter. Identical in operating principle to previous Super-D-Canters, this new unit is reported to operate successfully with no leakage of vapor at internal pressures up to 150 psi.

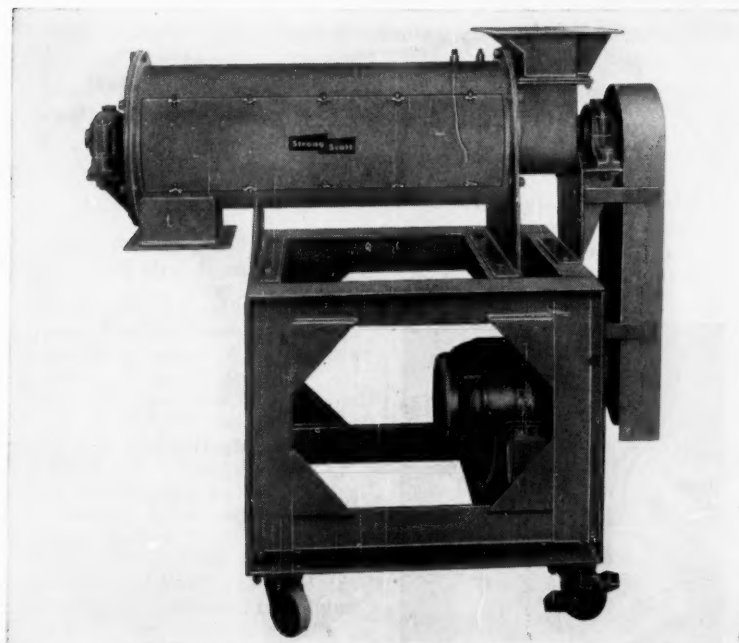
Slurry enters the machine at the bottom. Clarified liquor discharges from top of machine, dewatered cake from bottom.

Machine is larger than previous Sharples machines, will handle 200-250 gpm. and 10-12 ton/hr. solids. Driven at 2,000 rpm., the 29-in. dia. by 59 in. bowl produces maximum separating force of 1,640 times gravity.

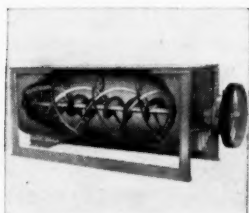
Rotating assembly of the P-7000 is suspended vertically from one bearing support, a unique design for this type of machine. Bowl is free to rotate around its own center of gravity.

Vertical design permits complete sealing of machine with one simple seal at the top of the rotating assembly, far from the contaminating constituents of the process stream. Bottom seal at the solids-discharge end of the unit is a motionless flange connection to the solids-collecting tank, conveyor or process vessel.—The Sharples Corp., 2300 Westmoreland Ave., Philadelphia, Pa. 100B

NEW HIGH SPEED MIXER FOR QUALITY FINISHING

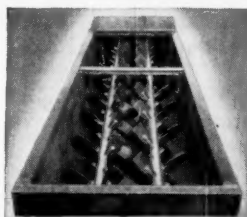


The Turbulizer produces a homogeneous mix, increases production while reducing mixing time and costs.



TRIPLE ACTION MIXER—Complete uniform blending in 2 to 7 minutes.

STRONG-SCOTT TRIPLE ACTION MIXER exposes each particle in the mixture to over 10,000 separate mixing actions per minute as it blends and folds. This produces a uniformly mixed product with 99.9% thorough distribution of minor additives.



TWIN ROTOR MIXERS—Accurate blending of liquids and dry mix at any speed.

TWIN ROTOR MIXERS are designed primarily for high percentages of liquid application to light weight ingredients, where product identity is to be maintained. A double shaft assembly with overlapping, adjustable paddles gently combine the liquids with the dry mix.

STRONG-SCOTT TURBULIZER

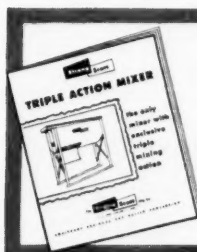
Provides Fast, Thorough Dispersion, Disintegration and Blending of Dry Materials, or Pastes Involving Liquids and Solids.

The **TURBULIZER** is a high speed, continuous mixer that will disintegrate and disperse fat pellets, chemical ingredients which have a tendency to ball or agglomerate, and other ingredients which can be broken by the paddles and thoroughly dispersed in the mixture. Product uniformity is accurately maintained as a result of high speed centrifugal forces created by the paddles.

It is also highly applicable where a fluffing action is desired on powdered material. Minor percentages of liquid may easily be added to dry mix with high efficiency and dispersion results.

The **TURBULIZER** is self cleaning and is built with sanitary seals at each end of the shaft. The interior is precision machined. Overlapping, adjustable paddles turn within a close tolerance to the chamber wall, providing a selective rate of material flow.

The **TURBULIZER** may be furnished in carbon or stainless steel and may be jacketed for hot water, steam or a refrigerant. Capacities will vary depending on the bulk density of the material and the degree of agglomerates encountered. Consult Strong-Scott for full details.



WRITE FOR FREE COLOR BULLETIN

For complete information on the equipment shown above, write to The Strong-Scott Mfg. Co.

The

Strong Scott

Mfg. Co.

DEPT. CE-01

Equipment Designed for Better Processing
451 TAFT STREET, MINNEAPOLIS 13, MINNESOTA

Cake thickness indicator for leaf filter....98A
Giant mixer blends carload of dextrin....100A
Solids-liquid centrifugal runs at 150 psi...100B
Temperature regulator for slow heaters...102A
Spray nozzle delivers wide angle coverage.102B
Pipe union provides self-aligning features.102C

Cost projector updates equipment costs...102D
Chemical pumps with steam jackets.....102E
Glass bubble-cap column protects silicon...104A
Front-end loader, first of new line.....104B
Detector monitors vapor pressure.....104C
Rotary pump offers double-lobe design....104D

Page number is also Reader Service Code number

For more details, use Reader Service Card

Temperature Regulator

Recommended for slow-heating process units.

A new temperature regulator consists of a Spence type E main valve controlled by the new T14 pilot. This pilot is recommended for slow-heating units such as storage heaters for oil and water, plating tanks, kilns and ovens.

Pilot automatically opens and closes main valve to maintain constant temperature. If equipment is rated for less than full line pressure, a type D pressure-reducing pilot can be connected to the T14 pilot to hold steam pressure on the equipment to a predetermined maximum.—**Spence Engineering Co., Inc.**, Walden, N. Y. 102A

Spray nozzle covers maximum area with spray angle of 120 deg. Offered in brass, steel, stainless steel in range of 12 capacities from 1/4- to 3-in. pipe thread connections.—**Spraying Systems Co.**, Bellwood, Ill. 102B

Stainless-steel Para-Seal fittings for both cleaned-in-place and take-down lines offer completely new self-aligning union

that is rigid with flush inner surface and metal to metal closure.—**APV Co., Inc.**, 133 Arthur St., Buffalo 70, N. Y. 102C



Cost Projector

Updates equipment cost indexes to present.

Worked up by Elias Frank of Chemico's Estimating & Cost Dept., and using Prof. W. L. Nelson's indexes from the *Oil and Gas Journal*, this neat gadget can save you time on estimating equipment cost.

Manipulation of logarithmic scales of cost indexes, relative to the year 1946, converts bygone equipment prices, to the present, or to any other year. Space is left for you to update it during, perhaps, the next two years.

A smaller scale in the center of the device relates costs of items of different capacities by means of the "six-tenth power" factor.—**Chemical Construction Corp.**, New York 36, N. Y. 102D

Chemical Pumps

Now available with steam jacketing to hold heat.

Goulds' line of Fig. 3715 chemical pumps are now being offered with steam jacketing. By avoiding cooling during pumping, user saves power, process water or product.

Specific applications include handling aqueous salt solutions where cooling may precipitate crystals that clog passages, score shaft or damage seal; low-melting point solids which must be kept above the melting point; high-viscosity liquids.

Fig. 3715 pumps are built in 10 sizes with capacity range and heads to cover the usual requirements of the process industries.—**Goulds Pumps, Inc.**, 38 Black Brook Rd., Seneca Falls, N. Y. 102E

Equipment Cost Index

Industry	June 1957	Sept. 1957
Avg. of all.....	224.1	225.0
Process Industries		
Cement mfg.....	215.3	216.6
Chemical.....	225.5	226.6
Clay products.....	209.2	210.4
Glass mfg.....	213.0	214.0
Paint mfg.....	216.6	217.4
Paper mfg.....	217.3	218.3
Petroleum ind.....	221.1	222.0
Rubber ind.....	223.9	224.8
Process ind. avg....	222.8	223.7
Related Industries		
Elec. power equip....	228.4	229.8
Mining, milling.....	226.9	228.0
Refrigerating.....	253.0	254.0
Steam power.....	212.0	212.6

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See *Chem. Eng.*, Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1957, pp. 266-7 for annual averages since 1913.

For More Information . . .

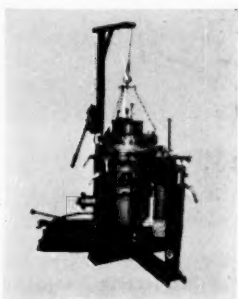
about any item in this department, circle its code number on the

Reader Service

postcard inside the back cover



Metallurgists ... ERASE HYDROGEN, OXYGEN AND NITROGEN FROM YOUR MELT!



KINNEY High Vacuum Equipment includes Evaporators in laboratory and high production sizes . . . High Vacuum Furnaces for laboratory determinations, pilot plant and large scale production models . . . High Vacuum Curing Ovens . . . Vacuum Degassing Equipment for Ferrous and Non-Ferrous Castings. The F-9 Furnace shown handles up to 5 lbs. of metal . . . induction or resistance heating with temperatures to 2000°C and over.

WRITE:

Get full information on new developments in KINNEY High Vacuum Pumps and complete engineered High Vacuum Equipment.



The elimination of contaminating gases provides much more than improved grain structure for ferrous and non-ferrous metals. Metallurgists find that High Vacuum imparts distinctly new attributes . . . in many cases the end product might well be considered an entirely new one.

Work with Titanium, Selenium, Germanium, Silicon, Magnesium-Fluoride and other substances emphasizes the great need for "clean" High Vacuum atmospheres to reach ever-higher targets in purity. And the tools to attain the clean High Vacuum . . . to erase Hydrogen, Oxygen and Nitrogen and other contaminants are:

Kinney[®]

HIGH VACUUM PUMPS

KINNEY Pumps comprise the most extensive selection of types and sizes in the entire High Vacuum field. There are single-stage Simplex and Duplex Pumps developing ultimate pressures of 10 microns (McLeod) . . . two-stage Compound Pumps with ultimate pressures of 0.2 micron (McLeod) . . . and finally, the famous KINNEY Mechanical Booster Pumps which develop ultimate pressures of 0.2 micron (McLeod) or better! Among these is the ideal Pump for your need!

KINNEY MFG. DIVISION THE NEW YORK AIR BRAKE COMPANY

3551A WASHINGTON STREET • BOSTON 30 • MASS.



Kindly send me literature on

☐ KINNEY HIGH VACUUM PUMPS ☐ KINNEY HIGH VACUUM EQUIPMENT

Name _____

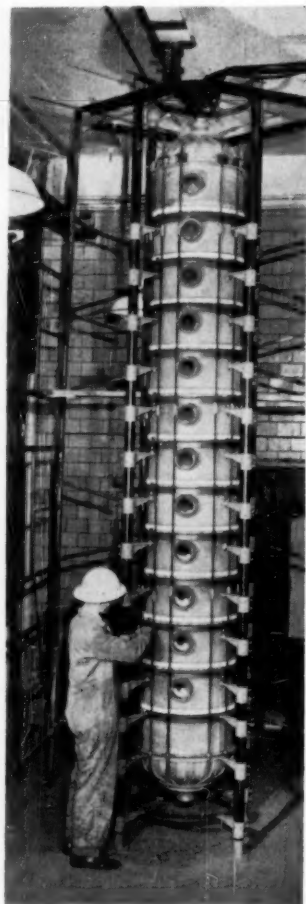
Company _____

Address _____

City _____

Zone _____

State _____



It's All Glass—16-Ft. Bubble-Cap Column

This 1-ton, 23½-in.-dia., all-glass bubble-cap distillation tower will soon help to achieve a high product purity in the manufacture of metallic silicon. A tie-rod network neatly binds the armored Pyrex-brand glass cylinders, conical end pieces, and Vycor-brand (96% silica) glass bubble-cap trays into a neat 12-deck sandwich. Envelope-type Teflon gaskets effectively seal the column.—Corning Glass Works, Corning, N. Y. 104A

Front-End Loader

New line features exceptional maneuverability.

Versatility, maneuverability, and ease of operation should make Euclid's new front-end loader, the Model L-7, a welcome addition to industry's family of intra-plant workhorses.

Compact design permits it to operate in confined areas normally inaccessible to most power equipment. Rear-wheel steering and a 4-ft. wheelbase confine the turning radius to a low 74½ in. An interconnecting valve between the foot brake and the driving clutches enables the operator to inch the L-7 into the most restricted of areas.

A 49-hp. Continental gasoline engine, connected to the front-wheel drive through an automatic transmission, moves the new loader at speeds up to 11 mph., forward or reverse. Rated payload capacity of the L-7 is 19 cu. ft. or a maximum lifting load of 3,000 lb. Euclid plans introduction of larger-capacity models soon.—Euclid Div., General Motors Corp., Cleveland 17, Ohio. 104B

Pressure Detector

Measures vapor pressure continuously.

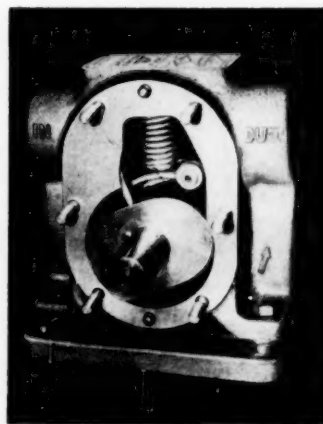
Now available is new continuous vapor-pressure detector, engineered by the Shell Development Co. Supplied in ranges varying from 50 to 750 psig., it keeps around-the-clock tabs on process-line vapor pressures.

Model 1157 measures the vapor pressure of gasoline and other low-pressure hydrocarbon streams; model 1158 satisfies high-pressure requirements and will also indicate the proportion of each constituent present in a binary LPG stream.

Detector operation requires precise control of the temperature and flow rate of a process-line drag stream as it passes through a specially designed "vaporization chamber." An integral Moore pressure trans-

mitter delivers a 3-15 psig. air signal proportional to the equilibrium pressure of the vapor within the chamber.

Electronic flow and temperature control units, and a test circuit are enclosed in explosion-proof housings to make the entire unit safe for use in hazardous areas (Class 1 Group D). The test circuit facilitates start-up and trouble-shooting procedures.—Hallikainen Instruments, Berkeley 10, Calif. 104C



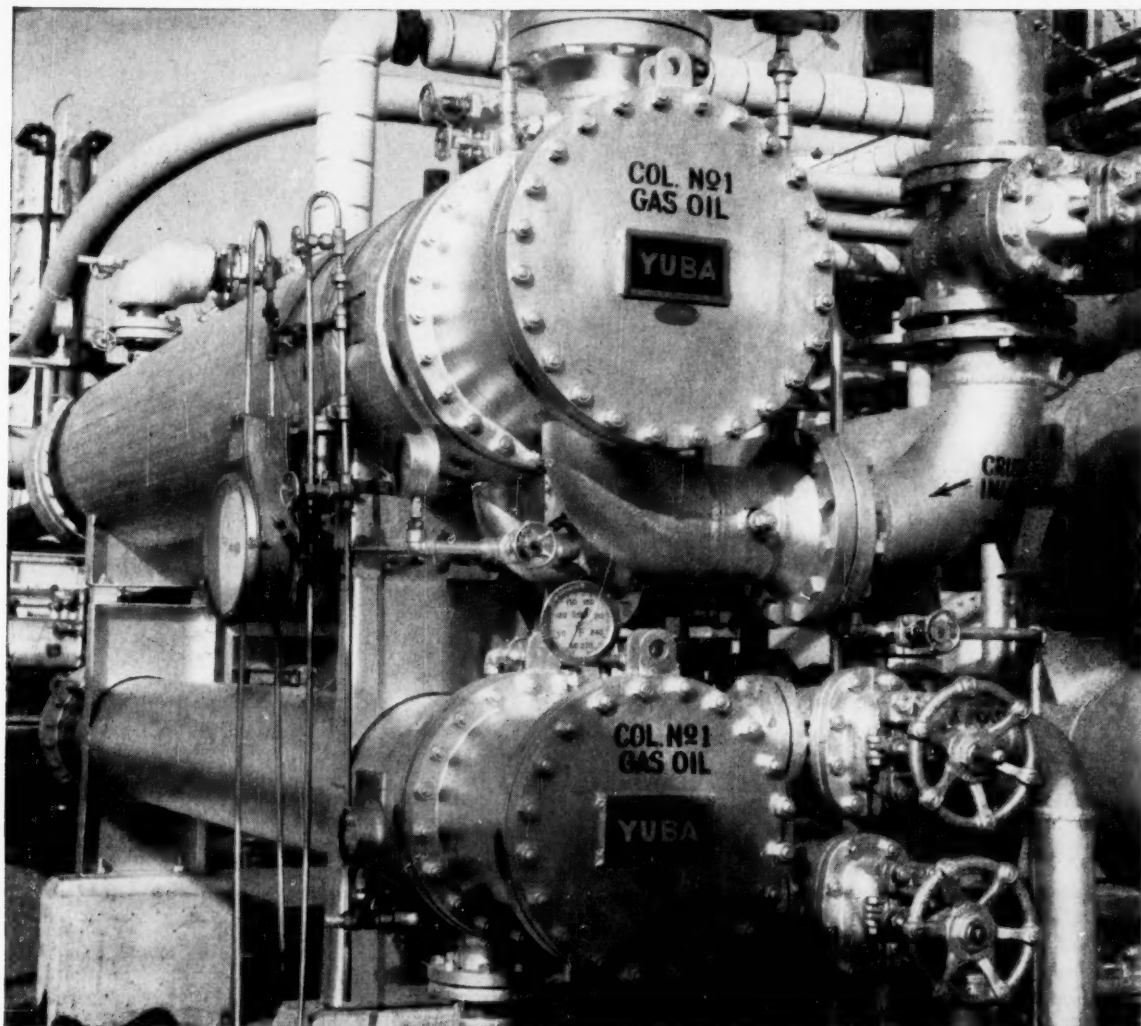
Rotary Pump

Under development four years, now available.

Revolutionary design incorporates high efficiency, versatility and simplified construction into Manton-Gaulin's positive-displacement "Twin-Lobe" pump.

Combined action of two lobes, keyed at right angles to each other on a single shaft, results in extremely smooth flow . . . no pulsation, foaming or churning. The only other moving parts are a pair of spring tension arms which form a seal between suction and discharge.

Twin-Lobe's design permits pumping of fluids ranging from volatile gases to pastes. Available in three models, it will deliver pressures up to 200 psi. and capacities up to 56 gpm. Construction is mainly of stainless steel and special alloys.—Manton-Gaulin Mfg. Co., Everett 49, Mass. 104D



WHAT YUBA MEANS BY ENGINEERED HEAT EXCHANGERS

The manufacturer of heat exchangers is the sales engineer who services your account...the design engineer who designs the equipment and selects the materials...the welding engineer who specifies the welding procedures...the quality control engineer who sees that incoming materials meet specifications . . . that top-quality work is per-

formed at every stage of manufacture...and the production control engineer who schedules your order so it will arrive the day you need it.

These competent people are to be found at YUBA's plants, in both the East and the West, where heat exchangers are made. Call YUBA for creative engineering and precision manufacturing.

YUBA

CONSOLIDATED INDUSTRIES, INC.

New York Sales Office: 530 Fifth Avenue
Branch Offices and Representatives in Principal Cities

Divisions Manufacturing Heat Exchangers

Yuba Heat Transfer Division, Monaca, Pa.
California Steel Products Division, Richmond, Calif.
Adco Division, Buffalo, N. Y.



Plant Building Takes a Breather

Fever-pitch spending has swelled industrial capacity well beyond sales levels. Result: Cutbacks in capital outlays for '58.

Research boom will spark new upswing
(story, p. 110)

William H. Chartener, McGraw-Hill Dept. of Economics

The decrease in spending on new plants and equipment—first since the recession year of 1954—is expected to amount to 16% for manufacturing companies as a whole. Chemical process companies will be holding closer to their record level of 1957; their spending in 1958 will be off only 7% from last year. And CPI 1958 spending will still represent a higher total than in any other previous year.

All such figures, from a new survey of industry's capital spending plans by McGraw-Hill's Dept. of Economics, indicate there will be a breather in the plant expansion boom of recent years. But, in general, the cuts will not be very deep and are not expected to last long.

Already more than three out of four chemical processing companies plan to maintain or increase their 1958 capital spending rate in 1959. Aggressive new product schedules will compel many companies to put in new facilities in 1959 or soon thereafter.

► **Paper Slips Most**—Big drop in

process industry spending in 1958 will come in pulp and paper, where plant and equipment outlays will trail 1957 by 24%. Stone, clay and glass products spending will be off by 9%, and rubber companies will match the CPI's average decline of 7%.

By contrast, petroleum refining outlays will actually rise 5%, according to present plans, while chemical companies will trim capital spending only 4%.

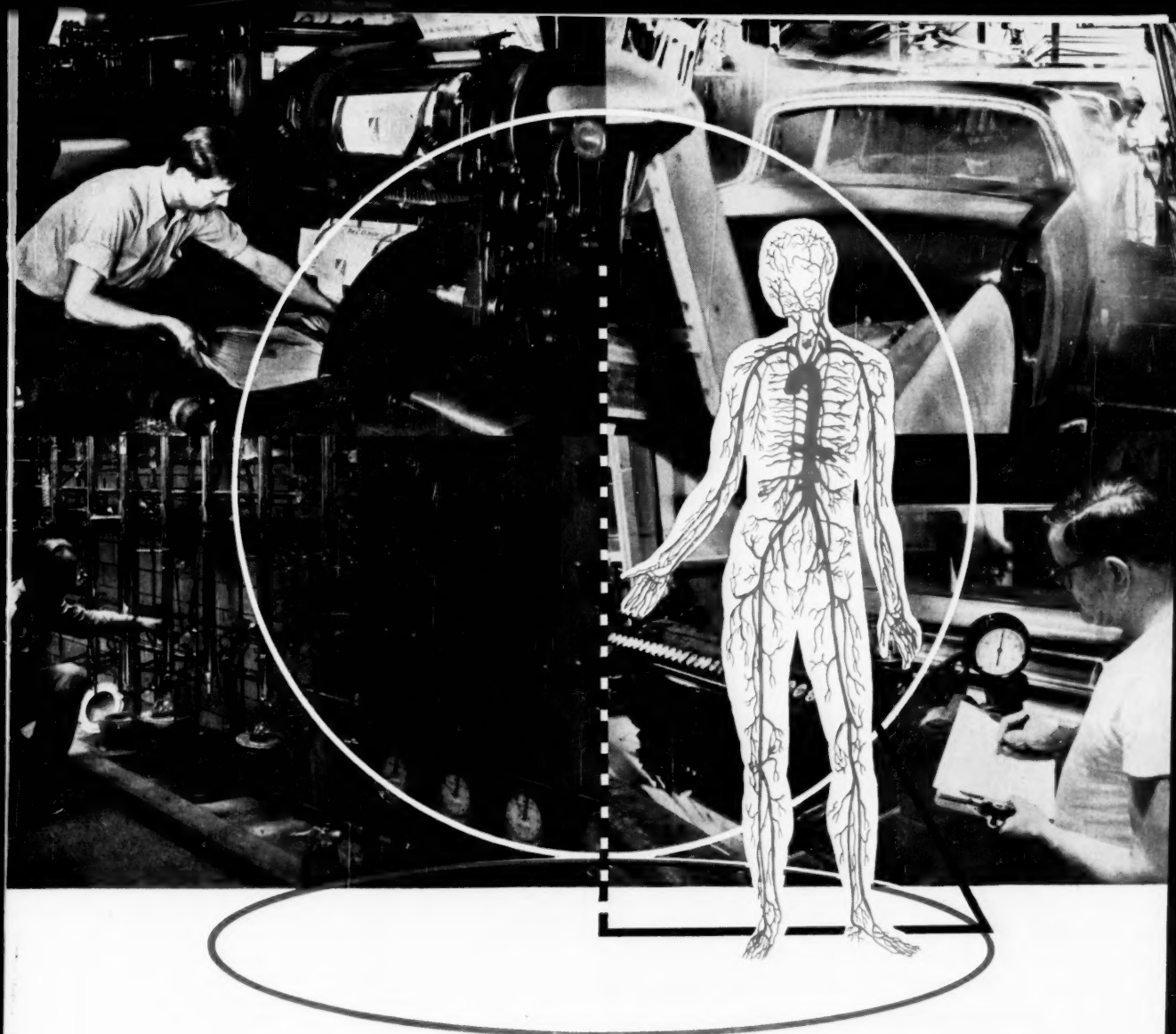
► **Too Much Capacity**—Main reason behind the lowered sights in plant expansion: Capacity has outstripped sales. Operating rates in all process industries have slipped since the end of 1956. Most companies are now running at less-than-preferred operating rates. (See p 108).

As productive capacity has increased through heavy expansion programs, smaller percentages of potential capacity have had to be used because order volumes have not been growing as fast. Chemical companies, operating at 90% of capacity at 1955's end, slipped to 83% by the end of 1956.

Declines in operating rates have occurred in other process industries. Paper ran at 100% in late '55, 96% at the end of 1956, only 90% last September. Stone, clay and glass product companies operated at 94% at the end of 1955, 90% at 1956's end and tailed off to 85% last fall.

In rubber industry and petroleum refining the drop in operating rates has not been quite so sharp, partly because capacity has not been expanded in these sectors as much as in other process industries. But they both have felt the pressure of temporary excesses in capacity in recent months.

► **Other Depressions**—In shaping reduced plant and equipment programs, the feeling that capacity has mounted too fast for markets is bolstered by a lukewarm business outlook for 1958. Industrial production wobbled through 1957 at levels that failed to match the peak hit at the end of 1956. And few economists expect much improvement this year. (Continued)



SOLVENTS . . . industry's life-giving fluids

When organic coatings and printing inks have places to go, like on automobile bodies and printing presses, it's the job of their oxygenated solvents to take them there and apply their films. Then, these remarkable vehicles evaporate at the precise rate required for the particular end use.

Celanese, a leading supplier of these industrial solvents, is conducting a continuing study into the problems of industry so that solvents of even greater usefulness and economy can be developed. This program has already produced an important family of specialized solvents for the paint and coatings industry. Manufacturers can now replace costlier fluids with

lower cost solvents that offer greater dissolving power, better flow, superior blush resistance, improved all-around performance. Special attention is even paid to the correct flash point.

Researching into the problems of industry . . . applying the findings to practical solutions to improve manufacturing efficiency . . . this is another example of Celanese research and product development teams working hand-in-hand to supply industry with basic and intermediate materials that meet specific requirements. Celanese Corporation of America, Dept. 553-A, Chemical Division, 180 Madison Ave., N. Y. 16. Celanese®

Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16

Basic reasons

Acids	Functional Fluids	Polyols
Alcohols	Gasoline Additives	Plasticizers
Aldehydes	Glycols	Salts
Anhydrides	Ketones	Solvents
Esters	Oxides	Vinyl Monomers

Celanese
CHEMICALS

. for improved products

Agricultural	Paper
Automotive	Pharmaceutical
Aviation	Plastics
Building	Surface Coatings
Electrical	Textiles

There have been strong arguments on the financial side for holding down capital spending,

too. Profit margins have been squeezed the past two years. Heavy investment programs have

drawn down cash holdings. And high interest rates continue to make borrowed money expensive.

Plans reported in the McGraw-Hill survey were, of course, only preliminary. Some may have been boosted in final budget reviews. But most companies seem inclined to take a breather before touching off another plant expansion boom.

► **Research Spending Up**—However, the groundwork is being laid for future investment in new producing facilities—via higher research and development budgets.

In chemicals, 57% of the reporting companies will spend more on research this year than last; the other 43% will spend about the same. A third of petroleum companies are upping R&D activities; two-thirds are spending the same as in 1957. In rubber, and in stone, clay and glass, all reporting companies will be spending the same or more than in 1957.

In only one chemical process industry—paper and allied products—did any companies report plans to reduce R&D spending in 1958. Even so, the 4% reporting reduced research outlays are dwarfed by the 65% that say they will spend more in 1958.

These research efforts will inevitably lead to new products, new processes, product or process improvements, or cost-cutting techniques. Pressure to cut costs and meet competition will compel companies to make the capital outlays necessary to put the results of this research to use (see story next page).

► **New Boom Ahead**—McGraw-Hill asked whether present R&D programs will lead to substantial expenditures on new plants and equipment in 1959 or later. In the chemical industry, 65% of the respondents answered they would. In other process industries the "yes" percentages are: paper, 42%; rubber, 91%; stone, clay and glass, 35%; petroleum products, 50%.

Thus, this increasing stress on research in company planning, at a time when sales and profits are disappointing, is the strongest indication that this year's cutback in capital spending is only a temporary reaction to a bulge in excess capacity.

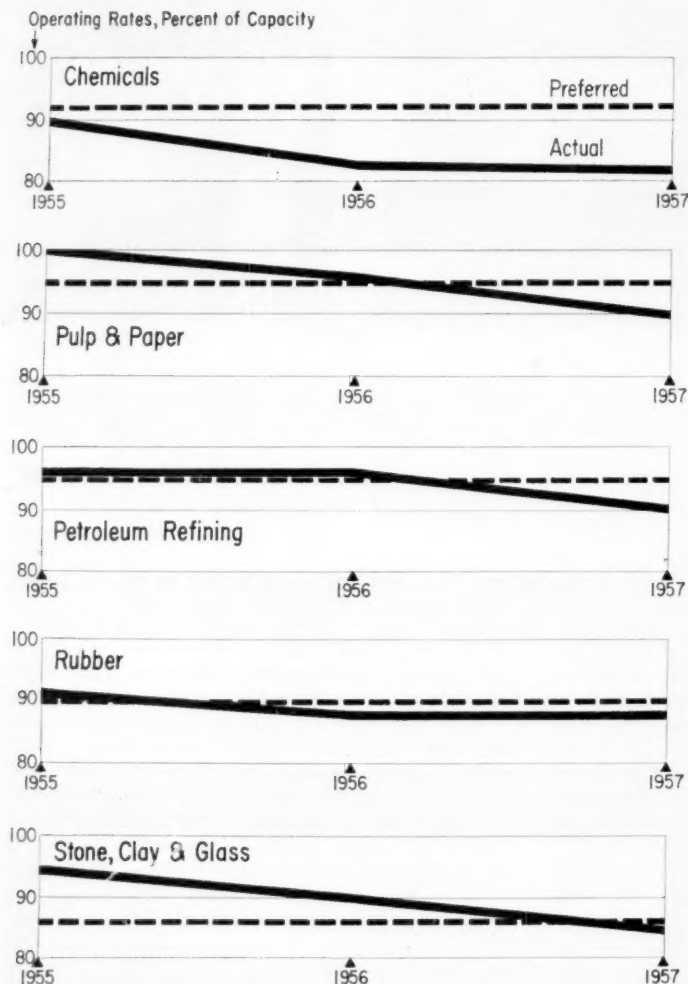
Chemical Processors Ease Up on Capital Spending

(Millions of dollars)

	1956*	1957	1958	% Change 1957-58
Chemicals.....	1,455	1,795	1,723	- 4
Pulp & paper.....	801	847	644	-24
Petroleum refining.....	711	889	933	+ 5
Rubber.....	201	208	193	- 7
Stone, clay & glass.....	686	604	552	- 9
All manufacturing.....	12,787	13,904	11,614	-16

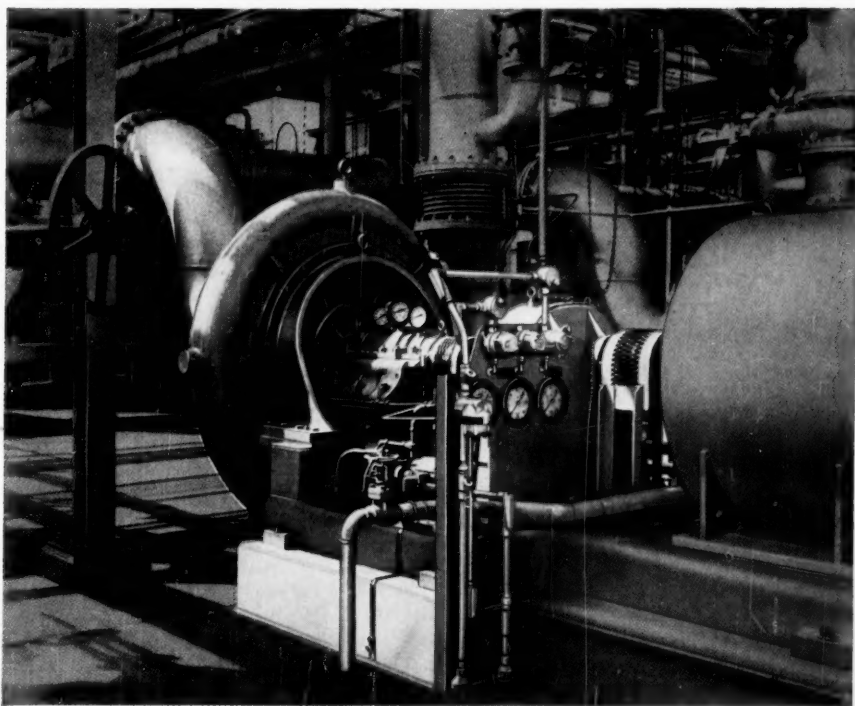
*U. S. Dept. of Commerce; Securities and Exch. Comm.; McGraw-Hill Economics Dept.

Productive Capacity: More Than Enough





FOR TIDEWATER OIL COMPANY'S GREAT NEW REFINERY



Process Design
—Ralph M. Parsons Co.

Constructors
—C. F. Braun & Co.

R-C
Centrifugal Equipment
purchased for
this installation

Three single-stage centrifugal blowers, two turbine driven and one motor driven. Each blower is rated at 11,500 cfm at 4.8 psig operating at 5100 RPM requiring approx. 320 HP

For additional data,
please refer to our section
in Chemical Engineering Catalog
or Mechanical Catalog
or write for Bulletin 120-B-14.

R-C Centrifugal Blowers Supply Combustion Air for Sulfur Plant

For the industry's largest sulfur-recovery plant at Tidewater's "refinery of the future" at Delaware City, Roots-Connersville centrifugal blowers supply combustion air for processing hydrogen sulfide from sour crudes to elemental sulfur.

One of the basic design requirements for this plant is extreme flexibility. When the refinery is operating on high-sulfur crudes, sulfur production may reach 340 long tons per day. With low-sulfur crudes, production may be less than one-fifth this amount.

To satisfy these widely varying requirements, Roots-Connersville centrifugal blowers assure positive control of air delivered to the reaction furnaces. Whatever the conditions may be, they provide the kind of dependability that results in continuous, efficient operation for long periods of time. Whatever the service, you can count on this dependability in Roots-Connersville centrifugal equipment in capacities from 1,100 to over 100,000 cfm.



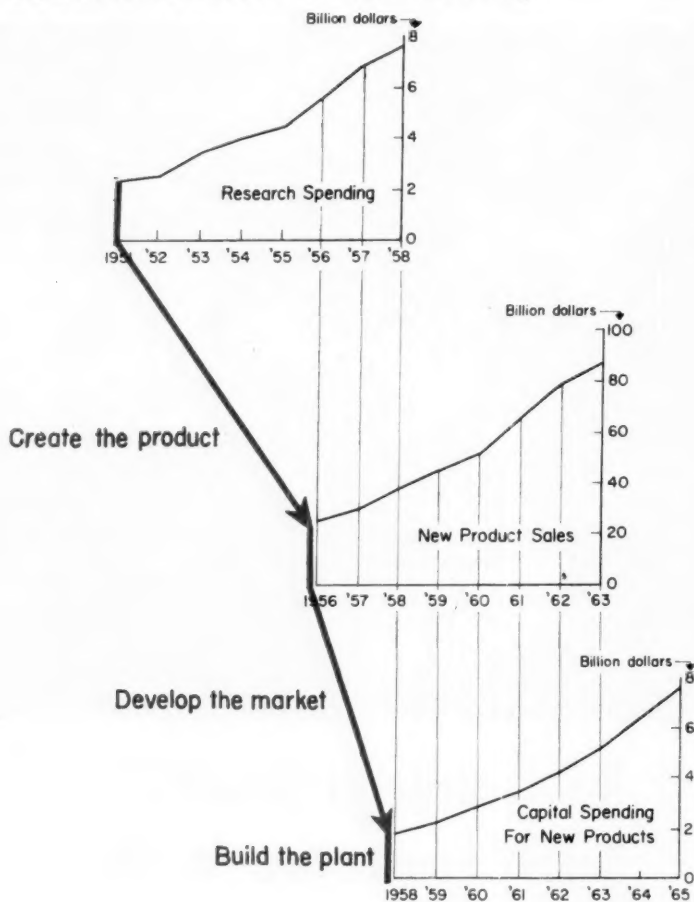
ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

158 Illinois Avenue, Connersville, Indiana. In Canada — 629 Adelaide St. W., Toronto, Ont.



How Research Leads to Plant Building



Research \$\$\$: The Big Spark

You can liken industrial research to a fuse lit about 1951, sizzling by 1954, and timed to touch off an explosive capital spending spree in the early 1960s.

William H. Chartener, McGraw-Hill Dept. of Economics

Research now underway in U.S. industry is paving the way for introduction of new products and processes at an unprecedented rate. This, in turn, sets the stage for the greatest boom in new plants and equipment in our history.

Because of the very nature of research and development, results will not show up overnight.

But the steep increase in research in the past few years makes this boom a near certainty sometime in the 1960s. And chemical process industries, with their record of high and steadily rising research expenditures, are sure to play a big part in it.

► **Phenomenon of the '50s**—Research is still a new activity to many companies. On its present

scale, research is new to almost everyone. Before 1950 very little was spent on industrial research. Then the outbreak of the Korean War brought substantial government contracts for research in aviation electronics and related fields.

But the upsurge of research programs for civilian products is of even more recent vintage—1954 and later. In 1954 the federal tax law was changed to allow business to deduct research outlays as a current business expense. With the end of wartime shortages, business grew more competitive; new products were needed to spark sales.

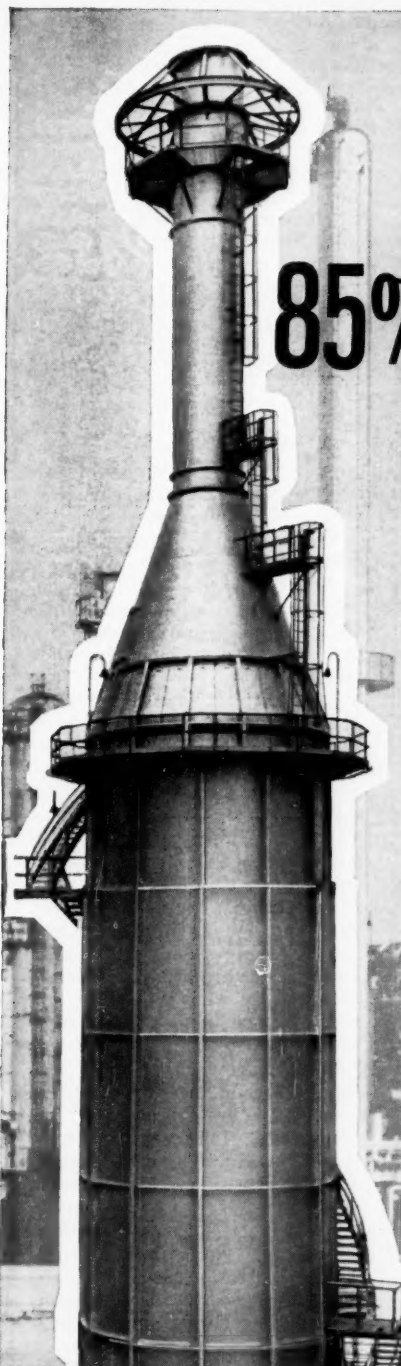
► **CPI Leads the Way**—Chemical and electrical industries have been ahead of others in research, which accounts for the flow of new plastics, synthetic fibers, drugs and electrical and electronic devices. As late as 1953, for instance, research took only 1¢/dollar of sales in industrial machinery and only 0.2¢ in steel. Compare this with 3¢/dollar of sales in chemicals and electrical machinery.

Even so, research outlays in the CPI have risen sharply in recent years. Comparing planned research outlays for 1957 (as reported to McGraw-Hill's Economics Dept.) and expenditures for 1953, we get these percentage increases: Chemicals, 46%; pulp and paper, 72%; rubber, 53%; stone, clay and glass, 74%; and petroleum refining, 54%.

Furthermore, the chemical process industries already plan to increase research spending by another 20% between 1957 and 1960. So this rising tide of industry effort in research and development ought to have a profound impact on products turned out and on processes used by the CPI.

► **Variable Timetable**—The timetable for translation of R&D into new products and processes can't be set down with any precision because every industry and every research project is different.

From the beginning of fundamental research on polymerization by condensation, begun by DuPont's Wallace Carothers in the late 1920s, until the first retail sale of nylon stockings, there was a gap of about ten years. On



BUTADIENE CAPACITY INCREASED

365,000 Tons/yr in 1957

85% THRU ISOFLOW HEATERS

...and "Isoflows" in five new Butadiene plants are additionally supplying 1,000,000 lbs/hr of superheated steam up to 1400° F

Butadiene capacity is mushrooming to meet the rising demands of synthetic rubber and chemicals. Of the new butadiene plants put into operation during 1957, Petrochem Isoflow Furnaces have been installed in the 5 largest, representing approximately 85% of the total increased capacity in the U.S.

Isoflow Furnaces efficiently perform two important heating functions, depending upon the butadiene process involved:
(A) To heat directly the butane-butene feed stock and steam to a high temperature for dehydrogenation.
(B) To supply highly superheated steam which in turn heats the butane-butene stock for dehydrogenation.

The unique design and operating features which have led to the wide acceptance of Petrochem Isoflow Furnaces include:

- Uniform Heat Distribution
- Maximum Fuel Efficiency
- Low Pressure Drop
- Low Maintenance
- Zero Air Leakage
- Minimum Ground Space
- Simplicity of Design and Construction
- Short Length of Liquid Travel
- Series, Multipass, all parallel flow
- Excess Draft for High Overload

For butadiene production, catalytic reforming or any other petroleum, petrochemical or chemical process there's a Petrochem Isoflow Furnace for any duty, temperature and efficiency.

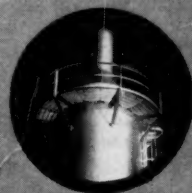
PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42nd St., New York 17, N. Y.

REPRESENTATIVES:

Rawson & Co., Houston & Baton Rouge • Wm. H. Mason Co., Tulsa • Lester Oberholtz, Los Angeles • Faville-Levally, Chicago
D. C. Foster, Pittsburgh • Turbox, Philadelphia • Flogg, Brackett & Durgin, Boston • G. W. Wallace & Co., Denver & Salt Lake City
International Licensees and Representatives: SETEA-S.A. Comercial, Industrial, y de Estudios Tecnicos, Buenos Aires, Argentina •
Industrial Proveedora, Caracas, Venezuela • Societe Anonyme Hourty, Paris, France • Societe Anonyme Balgo, Liège, Belgium • Petrochem
G.M.B.H., Dortmund, Germany • Hourty Italiana S.P.A., Milan, Italy • Birwelco Ltd., Birmingham, England



the other hand, a crash program to ready a new wonder drug for the market may take only a year or two.

After a new product does hit the market, there is usually a further period before consumer acceptance is strong enough to warrant the heavy outlays necessary to build new producing facilities. For a few months, or even years, the product may be turned out on makeshift equipment or in a small pilot plant.

We can make a rough generalization, however, on the time lag between start of large-scale research and introduction of a new product, and on the further lag before there is substantial investment in new plant and equipment to make the new product.

► **Seven-Year Average**—A survey of research directors conducted by the Economics Dept. of McGraw-Hill shows that the average time lag from start of research to new product is four to six years. And it is probably another two years before a large plant is built.

This adds up to an overall interim of roughly seven years from start of serious research until there is something approaching heavy impact on a company's output and capital expenditures.

► **Target: The '60s**—What does this mean in terms of a forecast? It means that the surge in R & D during the past three or four years will begin to pay off in significant sales of new products and outlays on new facilities sometime in the early 1960s. And the continued rise in R & D now projected through the next three years points to an increasing impact on new product sales and plant expenditures on into the late 1960s.

All this makes sense on other grounds, too. Population experts are forecasting another upsurge in marriages and births around 1965, when the huge numbers of babies born during the war and early postwar years reach marrying age. So in the early 60s industry will be starting to build new plants for these growing markets. And this expansion will include new products and new processes.

► **Impact Pattern**—Timing for different industries and different

products will vary considerably, even though practically every industry has become research-conscious in the last few years:

New Materials—Over the next few years we can expect an increasing flow of new materials—particularly plastics, new metallic alloys, new combinations of metals with plastics or ceramics. There can be little doubt about this phase, because it is already underway.

Consumer Products—Changes in materials and component parts will lead to extensive restyling of products for consumers during the next few years. And the continuing stream of small improvements will be accompanied by great efforts to magnify, via advertising and sales effort, their attractiveness to consumers.

Really basic changes in consumer goods, however, are fur-

ther off. All-plastic houses, turbine auto engines, personal helicopters and paper wearing apparel—things so new and different they will change the way the family lives—are not in sight until the mid-1960s. All these products are in research and development now, but more work is needed.

Capital Goods—By 1959 or 1960 there should begin to be a significant rise in capital spending for new machines—and for improved versions of older machines, through redesign or addition of new components and control devices. Application, for instance, of specialized computers to industrial control problems will make great headway.

New Processes—Not until the mid-1960s can we expect much in the way of new processes, in the sense of completely new methods of making things. Research of this type usually takes the longest to reach the commercially practicable stage. Also, new processes are frequently devised as economical ways to add new capacity, and present manufacturing capacity is relatively high compared to sales (see p. 108).

► **New-Process Hopes**—But several important industries are now working on radically new processes which they hope to have ready for the next big round of expansion. Some may well be ready by 1965.

The steel industry, for example, is counting on continuous casting for the expansion of the mid-1960s. Many metal products may be produced by direct reduction of ores and by powder metallurgy. The electric power industry hopes that substantial number of its plants will be atom-fueled by 1965. And the auto industry hopes to have the truly automatic factory for mass production of the turbine engine.

What all this adds up to, then, is this: Combined impact of new products and new processes—readied to meet an expanding market—will be felt in the mid-1960s. Groundwork is being laid now, in the form of a sharp acceleration in research spending. Meantime, there must be applied research work, pilot plant studies and market development. But the payoff is already in sight.

Chemical Consumption



Consumption by Industries

	July (Final)	Aug. (Final)	Sept. (Est.)
Coal products...	11.9	11.7	11.1
Explosives.....	11.7	11.5	12.4
Fertilizer.....	54.4	57.0	62.8
Glass.....	27.6	30.7	28.6
Iron & steel.....	16.3	16.9	16.5
Leather.....	4.1	4.2	4.2
Paint.....	35.6	36.6	31.9
Pet. refining.....	31.6	32.6	31.1
Plastics.....	22.2	25.5	25.6
Pulp & paper....	31.8	38.2	35.3
Rayon.....	25.5	26.6	26.9
Rubber.....	6.0	6.9	6.7
Textiles.....	8.4	9.9	9.3
Total.....	287	308	302

Sam Spinner's Mail Box



by Sam Spinner

CASE #1

Problem: Can we do centrifuging on a completely automatic basis?

Solution: You'll find the answer in the photograph and the flow chart at the right. Note that liquor outlet and solids discharge chutes operate simultaneously — automatically.

CASE #2

Problem: A particularly hard packed solid had given a plant owner considerable trouble in plowing from his centrifugal machine. His method of plowing consisted of jogging his motor to maintain a plowing speed. This resulted in constant inrushes of power that overheated and burned out his expensive Main Drive Motor.

Solution: AT&M positive speed Unloading Drive was installed as an integral part of the Main Drive Motor. This Unloading Drive, powered by a separate 2 H.P. plowing motor, gave a constant plowing speed of 45 R.P.M. through a rugged worm and gear drive. The operator was able to devote his entire attention to the plowing. The Main Drive Motor, relieved of its plowing duty, gave no further trouble.

CASE #3

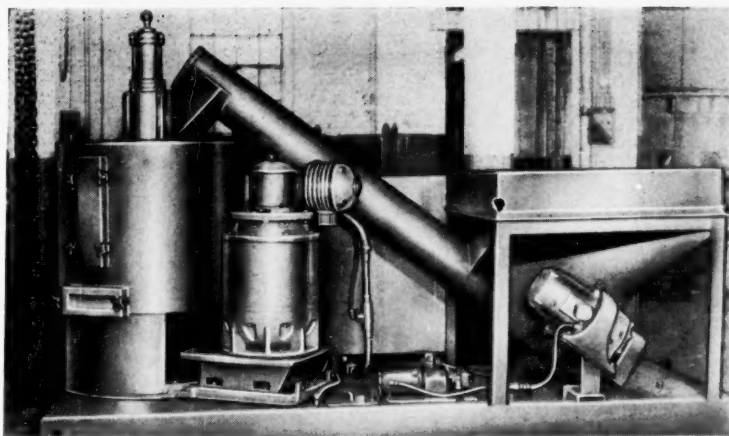
Problem: A valuable high viscosity slurry required a high speed clarifier to separate the solids from the liquor. Due to the characteristics of the slurry the conventional type baffle basket could not be used.

Solution: AT&M built a Link-Suspended Type Centrifugal that developed 2000 x gravity. The solid bowl basket with special baffles, built to distribute the load evenly, gave the proper separation.

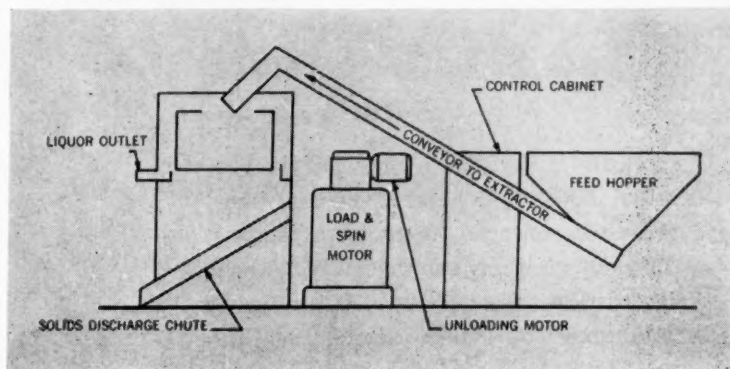
CASE #4

Problem: An application of a Suspended type centrifugal, with its convenience of plowing out through the bottom, was complicated by the lack of headroom to accommodate the conventional type Direct-Driven Machine.

Solution: A V Belt driven Suspended Centrifugal, with the motor suspended in an inverted position at one end of the frame, provided the answer to the limited headroom. An AT&M Unloading Drive mounted on this inverted motor provided a positive slow speed drive for plowing.



AT&M centrifugal for separating solids and liquids loads automatically, separates automatically, unloads automatically.



Solids Separated from liquids automatically — fast

This is another AT&M achievement in centrifuging for chemical processors.

A difficult problem of separating solids from liquids was solved by AT&M engineers. The installation is a completely electronic-controlled "Hy Par" base-bearing centrifugal. Loading and unloading is automatic. Liquid-solid separation is fast and efficient.

AT&M centrifugals are widely used in Separation, Dehydration, Coating, Filtering, Impregnation and Sedimentation processes.

New models make maximum use of time and space, with top safety. Send coupon for data.

AMERICAN TOOL & MACHINE COMPANY
1415 Hyde Park Ave., Boston 36, Mass.

Please send me my free copy of the new AT&M booklet "Centrifugal Force." I am interested in the following processes:

Separation ☐ Extraction ☐ Dehydration ☐ Clarification ☐
Coating ☐ Filtration ☐ Draining ☐ Thickening ☐ Impregnation ☐
Sedimentation ☐

SAVE TIME, SPACE
AND COSTS WITH

A.T. and M.
CENTRIFUGING

Name.....Title.....
Company.....
Street.....
City.....Zone.....State.....



2 NEW ADVANCES

...in Eye Protection

...in Respiratory Protection

AO 710 SPLASH GOGGLE

...for Splash, Spray and Impact Exposures

Developed in conjunction with E. I. duPont de Nemours and Company this American Optical goggle is recommended for protection against splashing liquids, spray and the impact of flying foreign particles. THE GOGGLE IS PARTICULARLY RECOMMENDED FOR USE IN THE CHEMICAL INDUSTRY AND WHERE HUMID CONDITIONS PREVAIL.

AO R-9921 POCKET RESPIRATOR

A "bit type respirator" — exceptional in performance, low in price, compact (3" x 3" x 2 $\frac{3}{4}$ "). Lightweight (4 oz.). Long Service Life. Multiple Protection. Noncorrosive. Practically Indestructible. Easily Disassembled. Easily Sterilized. Has complete inhalation and exhalation valve systems. Replaceable parts if needed. 3 companion models. Any of the 12 filter cartridges used in the AO R-5000 series respirator fits the pocket respirator.

Your nearest AO Safety Products Representative can supply you. Always insist on AO Trademarked Safety Products.

American Optical
COMPANY
SAFETY PRODUCTS DIVISION



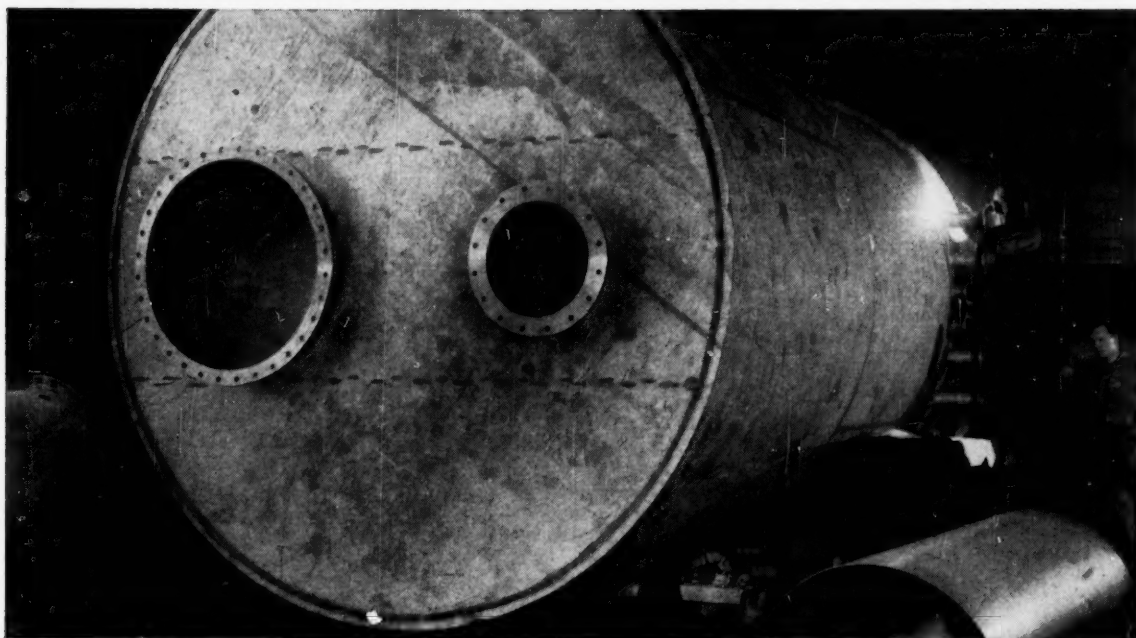
Protection
from Splash
and Fumes



QUICK FACTS

- Indirectly ventilated — no vents in frame or holes in lenses to allow splashes or particles to enter. Yet tests indicate the "710" is twice as fog-free as similar goggles.
- Lightweight, comfortable.
- Wide angle vision for greater safety and work efficiency.
- Fits over all types of personal and safety R glasses.
- Frame molded from non-irritating, non-toxic clear vinylite plastic.
- All parts replaceable — frame, lens, and all-rubber headband. (Hence goggle is easy to clean and sterilize.)
- Lenses are impact resistant plastic and conform to high safety and optical standards. Available in clear or green.

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES



ARMCO ELC STAINLESS

Keeps this Ammonium Nitrate Neutralizer "On Stream"

Reaction from $\text{NH}_3 + \text{HNO}_3$ has no adverse effect on this neutralizer made of Armco Stainless Steel Type 304 ELC. The reason is that all weld areas have the same corrosion resistance as the rest of the unit. The extremely low carbon content (0.03% max.) of Armco ELC Stainless prevented harmful carbide precipitation during fabrication and erection.

Armco ELC assures corrosion resistant welds without troublesome post-weld annealing, or the use of costly stabilized stainless grades. It also means that modifications of the neutralizer can be made in the field without danger of intergranular corrosion due to welding.

Armco offers you two extra-low carbon stainless grades. Type 304 ELC and Type 316 ELC can be used in the as-welded condition at temperatures up to 800 F. Both grades are available in sheets, strip, plates, bars and wire.

Why not give your processing equipment the low-cost, corrosion-safety factor that comes with Armco ELC Stainless Steel. For complete information on these money-saving special Armco Stainless Steels, just fill out and mail the coupon.

Armco Steel Corporation

1068 Curtis Street, Middletown, Ohio

☐ Send me a copy of the booklet "Armco's ELC Stainless Steels."

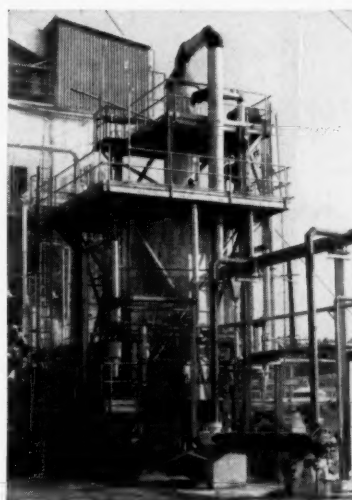
☐ Have salesman call.

Name

Company

Street

City Zone State



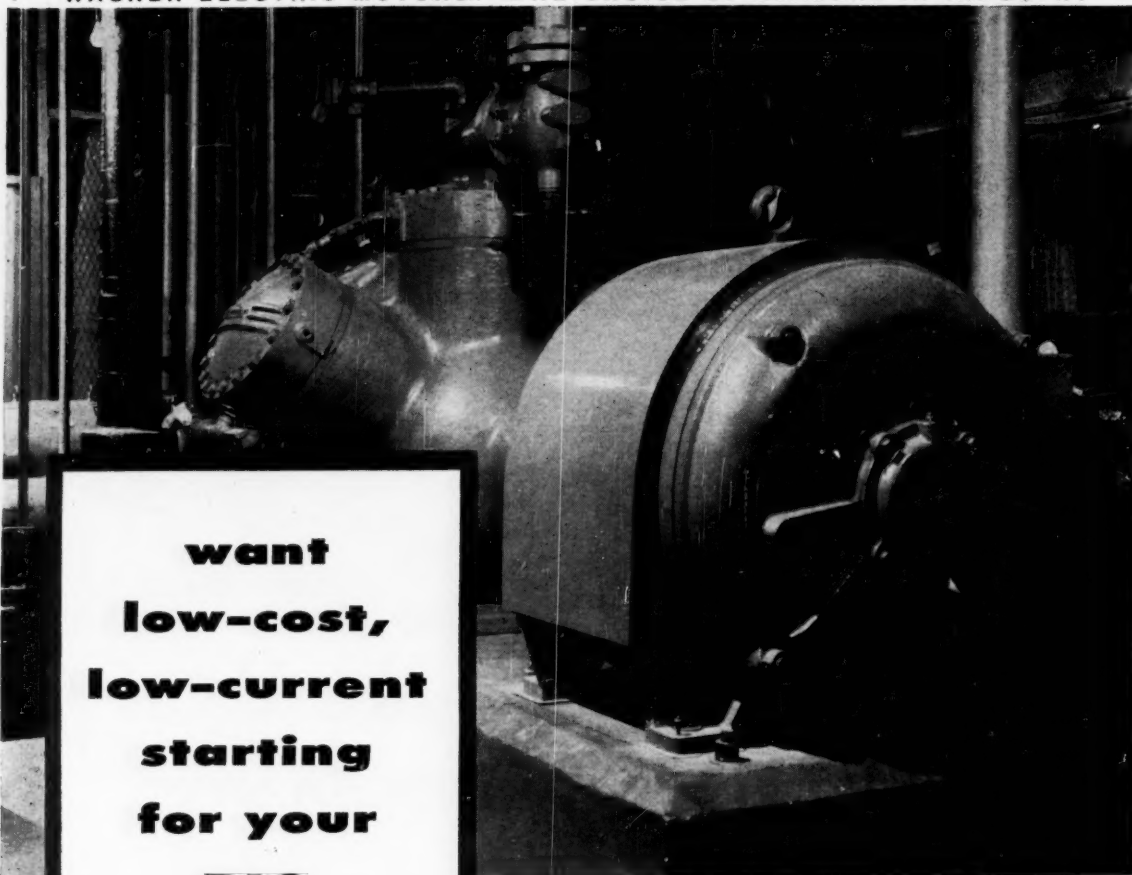
This 120 in. diameter Type 304 ELC stainless steel neutralizer is now "on stream" in a southern ammonium nitrate fertilizer plant. Welding includes some 30 pipe connections and baffles.

ARMCO STEEL CORPORATION

1068 Curtis Street, Middletown, Ohio



SHEFFIELD DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION



**want
low-cost,
low-current
starting
for your
BIG
MOTORS?**



Type RP polyphase motor—
in ratings to 500 hp. with
increment type starter.

WM5B-1

Specify Wagner Increment Motor-Starter Combinations

Part-winding starting is the simple, inexpensive way to limit the inrush of starting current in squirrel-cage motors up to 500 horsepower—and only the Wagner Increment Motor-Starter Combination gives you all these advantages:

LOW FIRST COST—Uses a standard Wagner Motor and a part-winding starter—no need for auto-transformers or resistors.

EASE OF INSTALLATION—Starter is compact and relatively light in weight, connections are simple and easy to make.

MINIMUM MAINTENANCE—The Wagner Motor requires only regular inspection, cleaning and lubrication—the starter needs very little attention.

APPROVED BY POWER COMPANIES—Meets all polyphase motor starting requirements of AEIC—EEI—NEMA—reduces voltage fluctuations—does not open the line during the starting period.

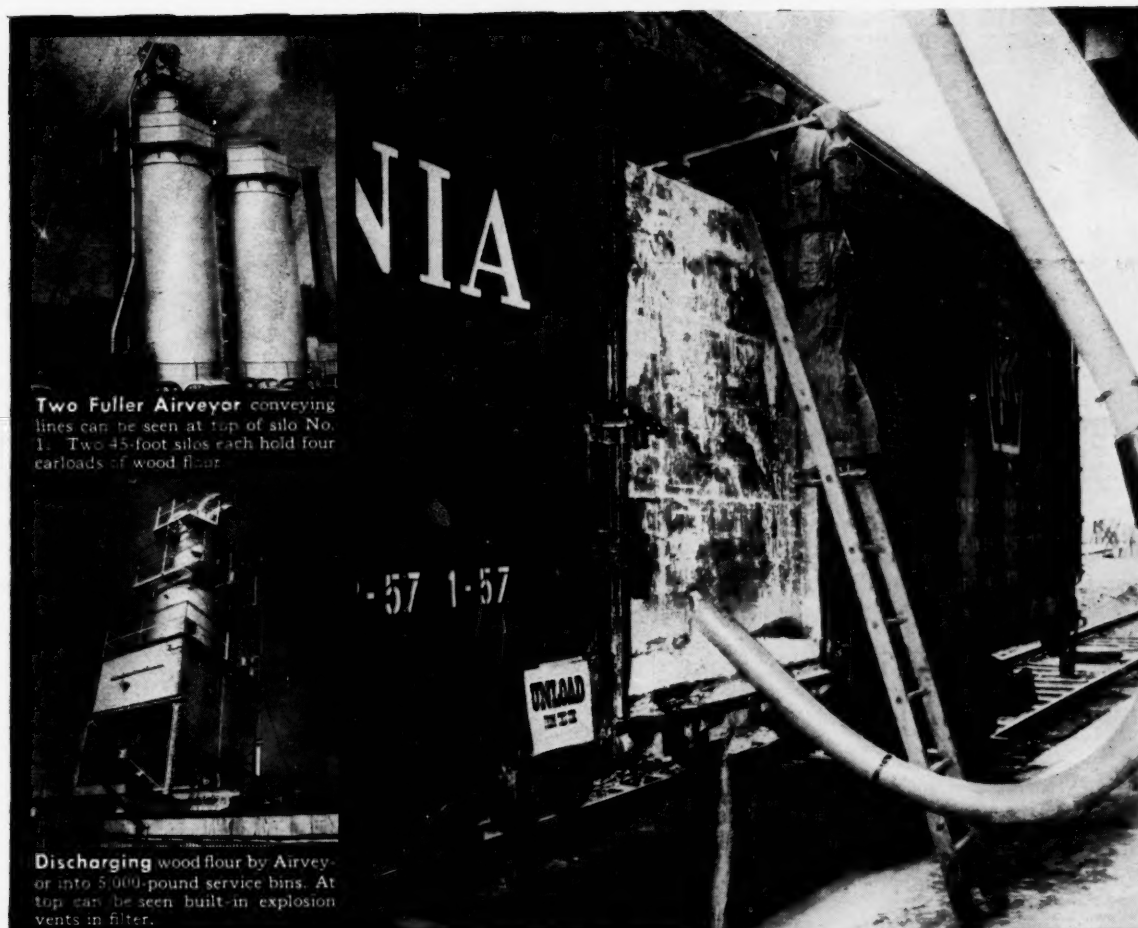
PROVED IN SERVICE—Wagner pioneered this Motor-Starter Combination—has been furnishing it for more than 18 years—its steadily increasing popularity is proof of its efficiency and dependability.

Why not take a look at Wagner Increment Motor-Starter Combination in operation? Ask your nearby Wagner Sales Engineer to show you an installation in your area. See how it works—judge for yourself, and let him help you select the combination that meets your requirements. Just call the nearest of our 32 branch offices, or write for Bulletins MU-128 and MU-195.

Wagner Electric Corporation
6407 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC



Two Fuller Airveyor conveying lines can be seen at top of silo No. 1. Two 45-foot silos each hold four carloads of wood flour.

Discharging wood flour by Airveyor into 5,000-pound service bins. At top can be seen built-in explosion vents in filter.

Workman starts unloading wood flour with minimum spillage as it is withdrawn from the box car by Fuller Airveyor.

GENERAL ELECTRIC SWITCHES FROM BAG-CARRYING TO **AIRVEYOR** CUTS HANDLING COSTS 60%

As part of a program to increase plastics production and reduce operating costs at its Pittsfield, Mass. plant, General Electric Company recently called in Fuller Engineers to design systems for handling wood flour in bulk.

Wood flour—used as a filler in phenolic molding compounds—was being handled in 75 and 100-pound bags. Unloading one carload of bags required 16 manhours. Bags were loaded on dollies and wheeled to a distant elevator.

SAFETY FIRST

The two pneumatic Airveyor® materials handling systems, engineered and manufactured by Fuller Company, were installed by its parent company, General American Transportation Corp., providing undivided responsibility. This installation resulted in a 60% saving in handling cost! The two

systems are handled by one full-time and one part-time operator. Manhours to unload one car have been reduced from sixteen to six!

In addition, all equipment is designed to conform to strict safety specifications set down by G-E engineers.

FLOW YOUR WOOD FLOUR

The Airveyor is a system that flows your wood flour through sealed pipes. It's fast, safe and self contained. The pipes can be placed close to ceilings, run underground or through walls.

Whether you process wood flour—or other dry granular materials—look into the many economies of Airveyor conveying. Write today for interesting, detailed literature on Airveyor and other Fuller pneumatic materials handling systems.

"See Chemical Engineering Catalog for details and specifications"

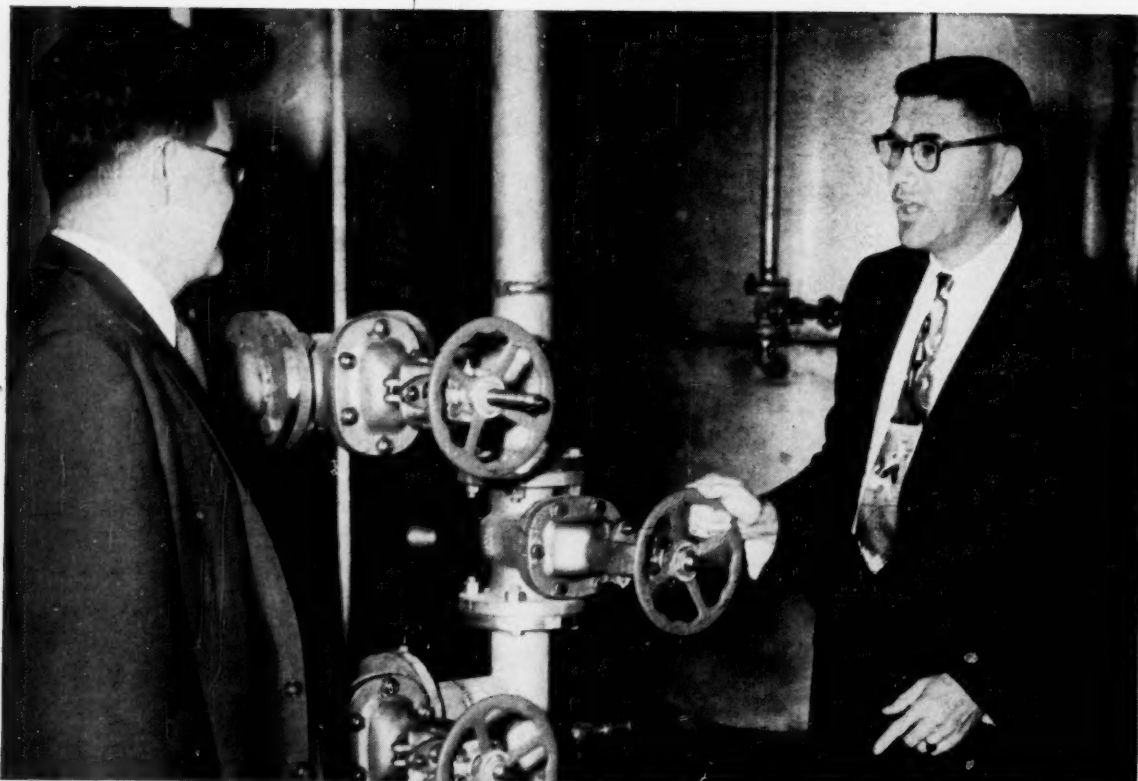


FULLER COMPANY

134 Bridge St., Catasauqua, Pa.

SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
Birmingham • Chicago • Kansas City • Los Angeles • San Francisco • Seattle

A-258
4449



BEN BUTLER (right), West Coast Production Manager, Borden Company Chemical Division. Left, Bernard Egan, Alaskan Copper & Brass Co., Cooper Alloy distributor for the Pacific Northwest.

BUTLER OF BORDEN CHEMICAL tells why he buys COOPER ALLOY stainless steel valves

Q. Mr. Butler, why does Borden Company Chemical Division require stainless steel valves?

A. In the manufacture of formaldehyde, its derivative resins, and corresponding industrial adhesives only stainless steel can meet our rigid requirements for corrosion, contamination and heat resistance.

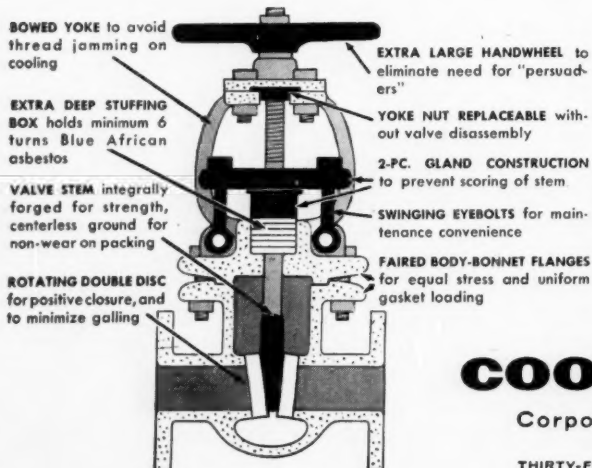
Q. What do you consider the most important factor in purchasing valves?

A. The truest measure of a valve is its operating performance. We have never received a complaint on Cooper Alloy valves from our engineers or operating personnel. The extra-large handwheel and unique valve design afford easy operation

with positive opening and closing, minimizing maintenance and down time.

Q. What other factors count in choice of valve supplier?

A. Service. The large and complete Cooper Alloy stock at Alaskan Copper affords immediate delivery on stainless steel valves and fittings, as well as pipe. That's a big reason why we buy Cooper Alloy!



A VALVE DESIGNED FOR STAINLESS!

The Cooper Alloy valve is not an adaptation of earlier brass and iron patterns. Cooper Alloy, with over 35 years of experience in handling stainless steel, created a valve *designed to be cast in stainless!* **Check the Special Design Features shown at left.**

As the little CA man below is saying: "You can tell a Cooper Alloy Valve as far as you can see it!" Write today for your copy of our folder "Design Factors In Stainless Steel Valves." The Cooper Alloy distributor near you will be glad to show you the complete line of Cooper Alloy valves and fittings, and their advantages. He can serve you promptly from local stocks.

COOPER ALLOY

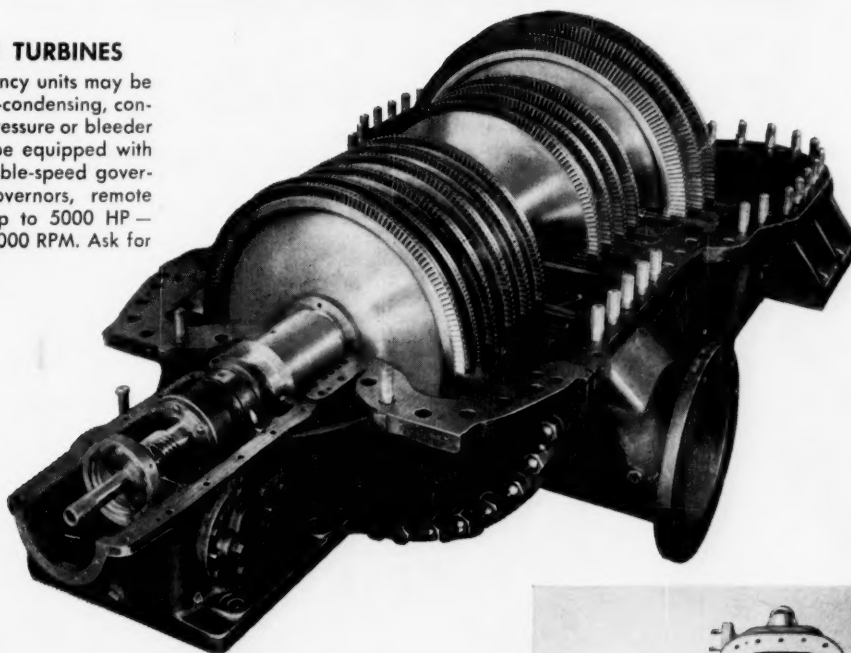
Corporation • Hillside, New Jersey

VALVE & FITTING DIVISION

THIRTY-FIVE YEARS OF STAINLESS STEEL PIONEERING

MULTI-STAGE TURBINES

These high-efficiency units may be designed for non-condensing, condensing, mixed pressure or bleeder operation. Can be equipped with constant or variable-speed governors, special governors, remote controls. Sizes up to 5000 HP — Speeds up to 10,000 RPM. Ask for Bulletin S-146.



There's a **Terry turbine** for every mechanical-drive requirement

The designs for Terry turbines are based on more than 50 years of successful experience in the manufacture of turbine drives *exclusively*. This specialization has resulted in Terry becoming one of the *leading producers* of mechanical-drive turbines in sizes up to 5,000 horsepower.

There are three basic reasons why Terry has been able to maintain this position of leadership: (1) a thorough knowledge of the requirements of mechanical-drive turbines, (2) a willingness to build "a little something extra" into each machine to assure trouble-free operation, and (3) an acknowledgement of the company's responsibility to stand behind the performance of every turbine sold.

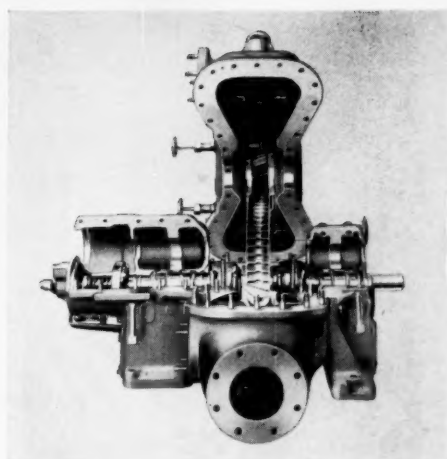
These are also the reasons why you should consider a Terry turbine for your next mechanical drive. In the meantime, send for bulletins describing any of the types of machines illustrated.

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

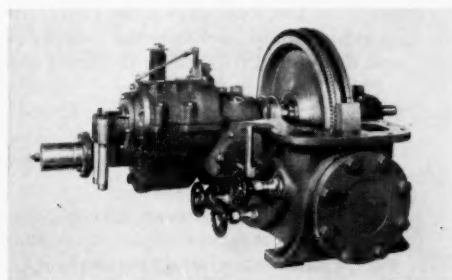
TT-1209

CHEMICAL ENGINEERING—January 13, 1958



SOLID-WHEEL TURBINES

Famous for sure dependability and ease of inspection. Can be started cold — no preliminary warming required. Available in vertical designs depending on frame size. Capacities from 5 to 2,000 HP. Described in Bulletin S-116.



AXIAL-FLOW IMPULSE TURBINES

Built with one, two or three rows of high-grade stainless steel blading, these turbines combine efficiency with durability. Available in designs for moderate and high steam pressure. Bulletin S-143.

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

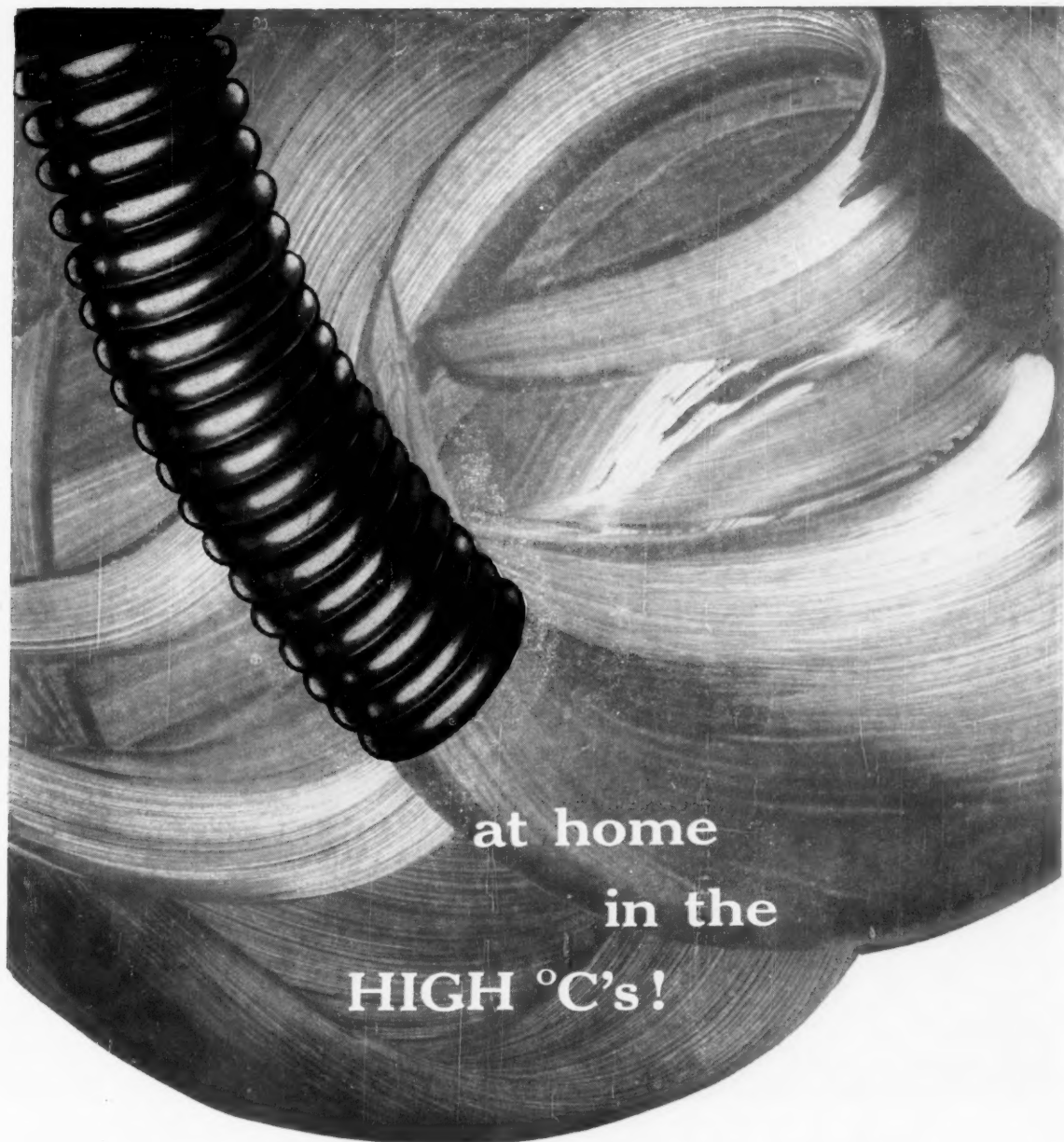
The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request.

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.



at home
in the
HIGH °C's!

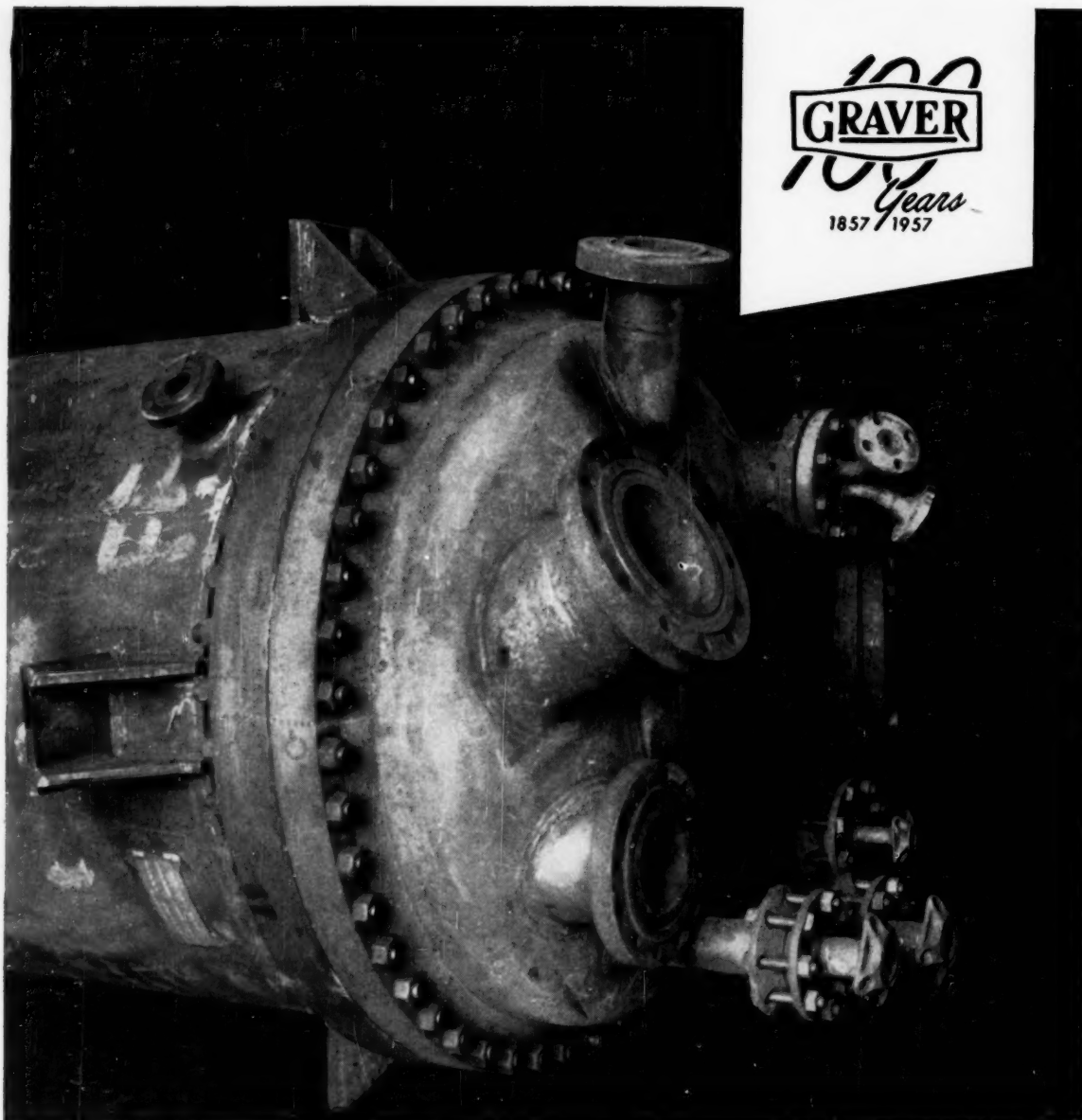
PUT ATLANTIC FLEXIBLE STAINLESS STEEL HOSE TO WORK in any inferno of high temperature and high pressure corrosive gases and liquids. It Stands Up! . . . Every inch . . . **JOB TESTED & CERTIFIED . . .** for unequalled leakproof qualities, durability, strength and lightness. Use it to control movement and vibration . . . correct misalignments . . . to compensate for expansion and contraction . . . in process lines . . . for loading and unloading.

Available in sizes 1/4"-4" I.D. inclusive with appropriate fittings. Produced in various alloys of stainless steel — in monel, bronze, and carbon steel. Write for Bulletin 21-A. See our Catalog in Sweet's File for Product Designers.

ATLANTIC METAL HOSE CO., INC.

329 Dyckman Street, New York 34, N.Y.





GRAVER
100 Years
1857-1957

When the Pressure Is On . . .

. . . for more efficient processing equipment operating at higher pressures and temperatures, experienced fabricating skills are important. This pressure vessel in carbon steel, designed to withstand 300 psi at 270°, is one of many types of vessels Graver fabricates to customer requirements in conformance with the ASME Code. Eminently satisfactory performance and long-life is assured when Graver's century-aged skills are employed. When high pressures and temperatures are involved, it is a sound decision to discuss your requirements with Graver.

GRAVER

*Building for the Future on
a Century of Craftsmanship
in Steels and Alloys*

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

New York • Philadelphia • Edge Moor, Delaware • Pittsburgh
Detroit • Chicago • Tulsa • Sand Springs, Oklahoma • Houston
New Orleans • Los Angeles • Fontana, California • San Francisco



ESSO LAKTANE *RSVP*

Here's an unusual solvent in search of further uses. Wherever you need a high-solvency, fast-drying solvent with controlled evaporation, a "clean" odor, low residue, and reasonable price, we suggest that Esso Laktane may well be able to *cut your costs and improve the results*. A product of Esso Research, it is already the proven quality-leader in rotogravure printing and in the lacquer industry. But we think you'll be interested in its uses in producing neoprene rubber products and vinyl organosols, among many other potential uses. With uniform quality and *immediate availability* as well as *low cost*, you'll find that you are indeed *answering an invitation to higher profits*. Esso Standard Oil Company, Inc., 15 West 51st Street, New York 19, New York.



PETROLEUM SOLVENTS



Worthite filter feed pump at Farmers Chemical Company, Joplin, Mo. Worthite is a Worthington Corporation trademark

for their corrosion-resisting, nickel-containing alloy. Composition: 24% Ni, 20% Cr, 3.25% Si, 3% Mo, and 1.75% Cu.

Made of nickel-containing stainless steel...

Long-lasting parts in this pump take phosphate-gypsum slurry in easy stride

In a plant producing high analysis phosphate fertilizer, this Worthington Corporation filter feed pump does a bang-up job with hard-to-handle gypsum slurry.

And that's understandable—because impeller and impeller casing, shaft and suction head are all made of Worthite, a cast Ni-Cr-Mo austenitic stainless steel containing 24% nickel.


The pump pictured here, for example, handles slurry with a dilution of 1.4 parts of solution to 1 part of solids. Solution is 32%

P₂O₅ with dissolved calcium sulphate, 1% free H₂SO₄, up to 3% hydrofluosilicic acid and fluosilicates and traces of hydrofluoric. Solids are primarily 100-400 mesh gypsum with about 5% 60-100 mesh unattached phosphate particles, mostly silica. Temperature: 158°F. Specific gravity: 1.66. Flow: 480 gpm.

In this service, impeller, shaft and suction head have an average life of 26 months, the impeller casing 31 months. Under slightly less severe conditions in the same

plant, other Worthite pumps have had no replacement of parts in three years of continuous use.

Perhaps a cast or wrought stainless steel containing nickel can help *you* combat corrosion and abrasion, or meet some other specific need. For information to guide you in selecting the right alloy, get in touch with Inco's Development and Research Division. They're always glad to be of service to metal users.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street  New York 5, N. Y.

INCO NICKEL

NICKEL ALLOYS PERFORM BETTER LONGER

New **Tri-Sure**[®] Clinch-on Nozzle

Trade Mark

Now **PAIL FILLERS**
can install
Tri-Sure[®] assemblies
after filling

More than
24
variations
applicable
to **ONE**
standard
opening

Tri-Sure
Reversible
Spout
Assemblies

Tri-Sure
Threaded
Spout
Assemblies

Tri-Sure
Tru-Pour
Collapsible
Spout
Assemblies

Tri-Sure
Push-Pull
Spout
Assemblies

Tri-Sure[®] Pail Closure Assemblies are now designed with nozzles having clinching rims that fit one standard opening—so that the filler can equip a pail with any one of more than 24 different variations of assemblies.

Pails are delivered to the filler with the opening formed and covered with a dust cap. After filling the pail, the Tri-Sure Assembly is just clinched to the neck of the opening. This is a simple, fast operation.

This new Tri-Sure Clinch-on[†] Nozzle gives the filler a simple, easy way to select and install the correct closure for every product and pouring problem. And it gives the user the closure he wants!

Let this revolutionary new Tri-Sure Clinch-on Nozzle solve your pail closure problem permanently—with an appreciable saving. Send now for folder giving full details on the complete line of Tri-Sure Clinch-on assemblies. Then specify the Tri-Sure Clinch-on opening to your pail supplier. Order the assembly best suited for your product direct from us.

^{*}The Tri-Sure Trademark is a mark of reliability backed by over 35 years serving industry.

[†]Patents Pending.

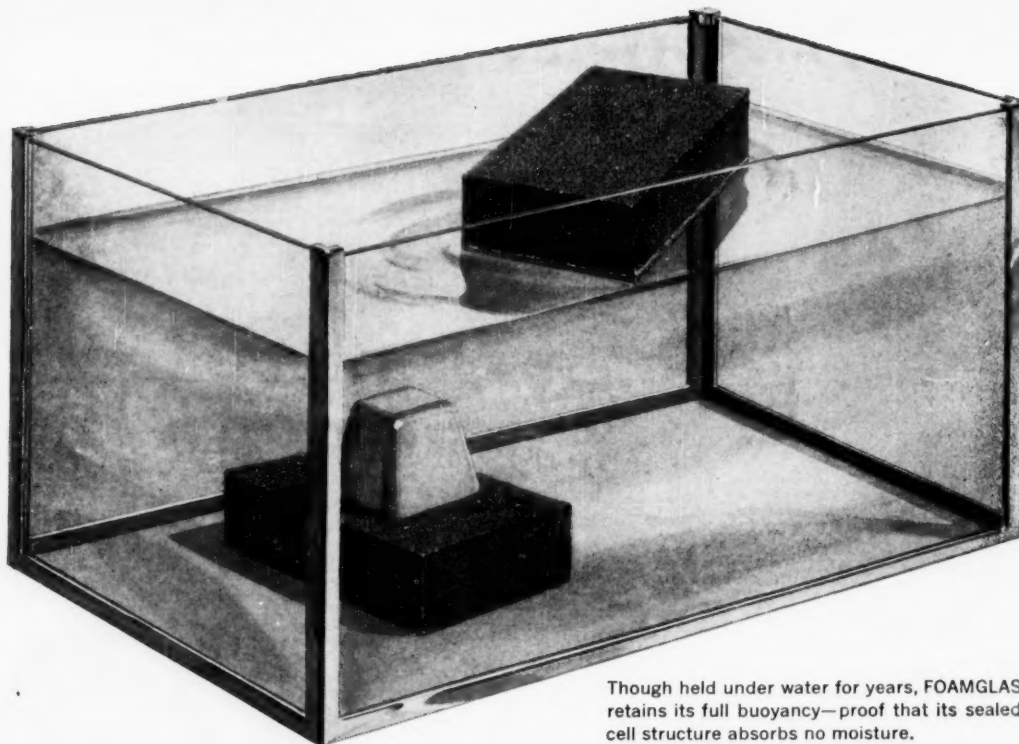
AMERICAN FLANGE & MANUFACTURING CO. INC.
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
CHICAGO, ILL. • LINDEN, N. J. • NILES, OHIO



Tri-Sure Products Limited, St. Catharines, Ontario, Canada
Tri-Sure S/A Indústria e Comércio, São Paulo, Brazil
American Flange & Manufacturing Co. Inc., Villawood, N. S. W., Australia
Compañía Mexicana Tri-Sure S/A, Naucalpan, E. de México, México
B. Van Leer N. V., Stadhouderskade 6, Amsterdam, Holland
Van Leer Industries, Ltd., Seymour House, 17 Waterloo Place, Pall Mall S. W. 1, London, England

Copyright 1957, American Flange & Manufacturing Co. Inc.





Though held under water for years, FOAMGLAS retains its full buoyancy—proof that its sealed cell structure absorbs no moisture.

FOAMGLAS[®]

INSULATION

is waterproof

... not just water-resistant!

FOAMGLAS insulation stays dry before, during and after application—maintains its original insulating value on the roof, walls, piping or equipment it protects. Since FOAMGLAS is completely inorganic, it can't burn, is acid-proof and dimensionally stable. Write for latest literature.



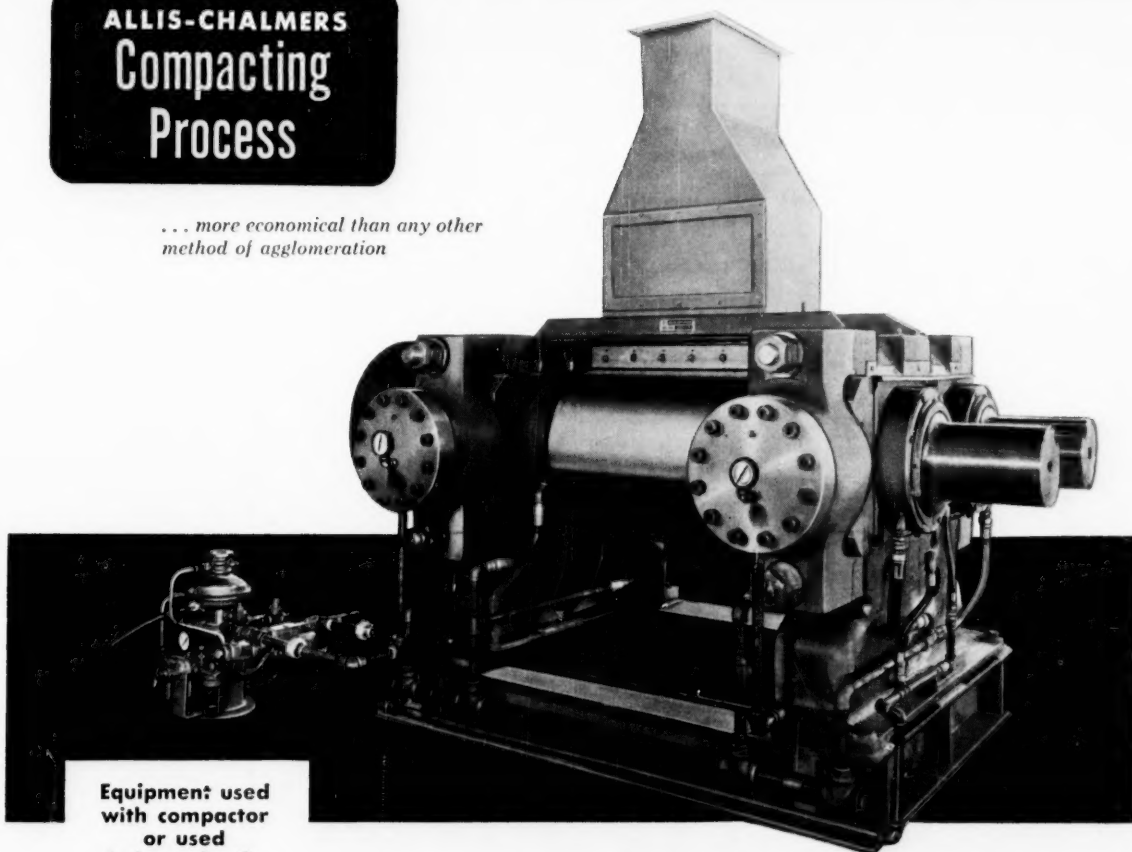
[®] Pittsburgh Corning Corporation

Dept. H-18, One Gateway Center, Pittsburgh 22, Pa.

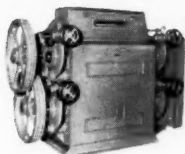
In Canada: 57 Bloor Street West, Toronto, Ontario

ALLIS-CHALMERS Compacting Process

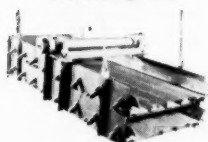
... more economical than any other
method of agglomeration



Equipment used
with compactor
or used
independently



Granulating Mill



Aero-Vibe Screen



Gyrotory Screen

Upgrade for Profits ... Mechanically

Precise control of *particle size, density and solubility factors* is now assured with the Allis-Chalmers compacting process. The heart of this efficient, completely mechanical system is this new Allis-Chalmers compacting mill.

Converts Loss into Profit

By-product material, too fine for use, from the original process, is first densified into slabs or flakes in the compacting mill. Agglomerated product is then granulated in the roller-type mill and separated in the vibrating or gyrotory screen. This conversion of by-product material into a usable product changes loss into added profits.

Get Bulletin 07B8836 for the complete story. Ask your A-C representative for a copy, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

Aero-Vibe is an Allis-Chalmers trademark.



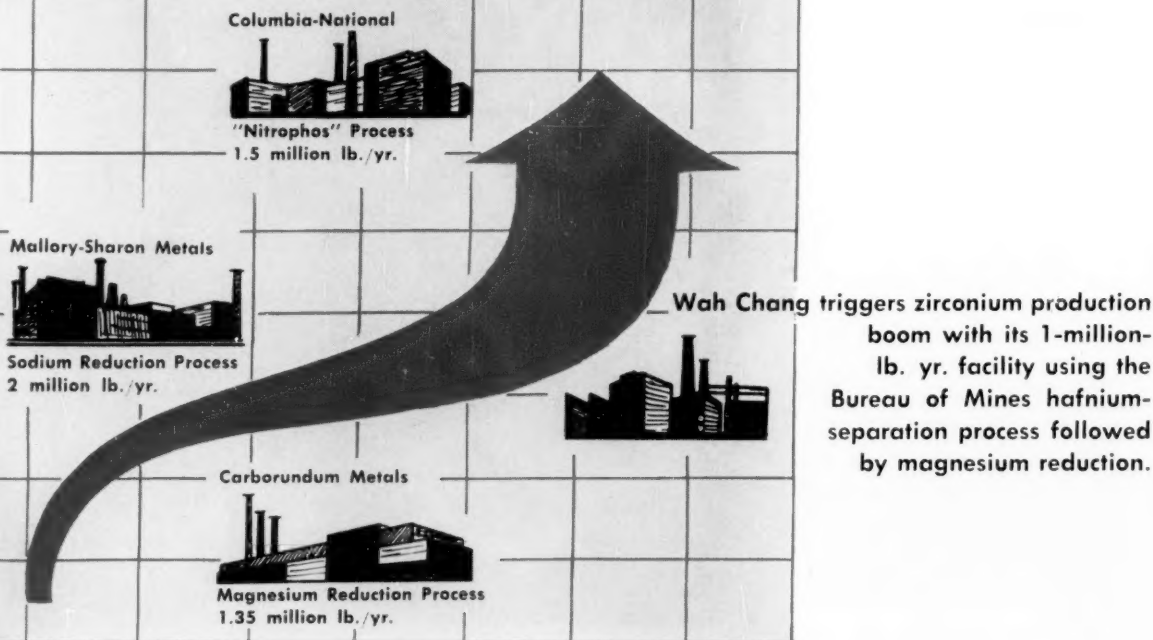
A-5582

ALLIS-CHALMERS

PRACTICE . . .

PROCESS FLOWSHEET

EDITED BY T. PETER FORBATH



Zirconium Now Sweeps Into the Big Time

ZIRCONIUM, only recently shucking its status as a lab curiosity, now launches into the million-dollar, million-lb./yr. big time. New companies, new plants and new expansions—spurred by zirconium's almost matchless utility in nuclear reactors and its superb corrosion resistance—are the order of the day.

Last November, little-heralded Wah Chang Corp. delivered the first punch that kicked open zirconium's big commercial round. It brought to full capacity a \$5-million, 650,000-lb./yr. installation at Albany, Ore. scant weeks before its more-talked-of rivals got rolling with their big plants. A completely integrated operation, the new facility goes all the way down the line from zircon sand through the tricky hafnium separation stage to turn out reactor- and commercial-grade (2% Hf) zirconium sponge with a hafnium product on the side.

This plant joins the Bureau of Mines' pioneer commercial installation at Albany that Wah Chang's been operating since 1956. Together they hand WC a total zirconium output of over 1 million lb./yr. of which 300,000 lb. are ticketed for the AEC.

Carborundum Metals has followed hot on WC's heels. On stream since 1953 with a 150,000-lb./yr. plant at Akron, Ohio, it started up a 1.2-million-lb./yr. facility

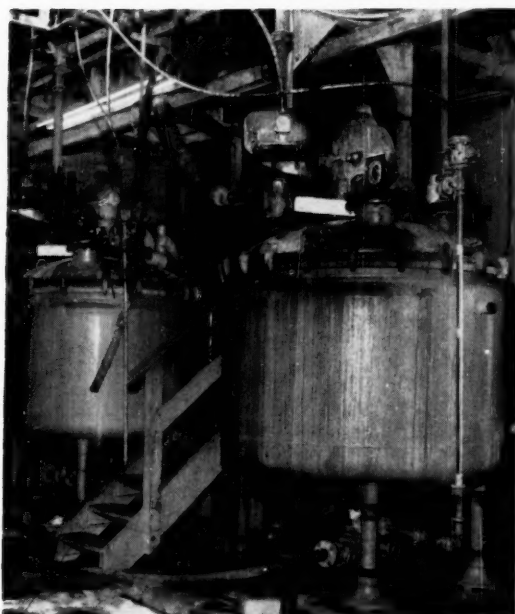
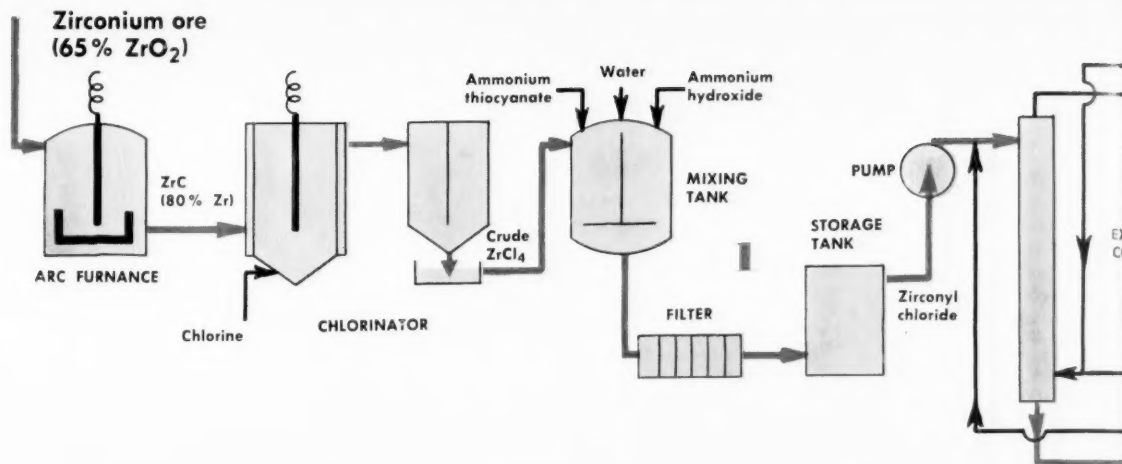
at Parkesburg, W. Va. before 1957's end. Now Mallory-Sharon Metals is completing shakedown runs on its 2-million-lb./yr. Ashtabula, Ohio plant. And Columbia-National is ironing out the bugs in its 1.5-million-lb./yr. installation at Pensacola, Fla.

► **Classic Flowsheet**—In a field brimming with process innovations and variations, Wah Chang operates what may be termed the classic zirconium flowsheet. It combines the Bureau of Mines' hafnium separation scheme with magnesium reduction of zirconium tetrachloride.

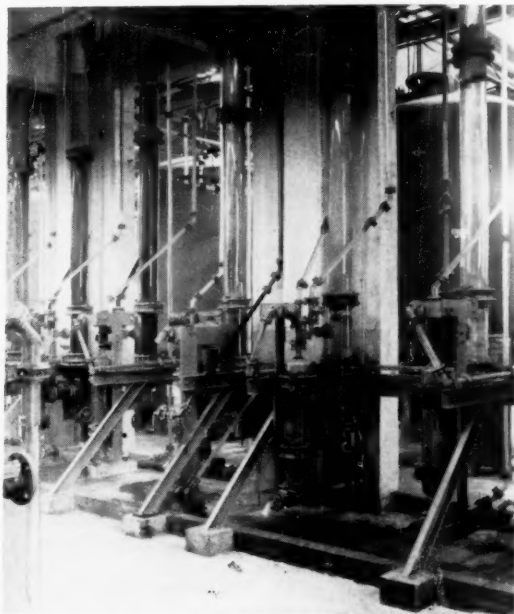
Zircon sand (chiefly zirconium orthosilicate) is first converted to zirconium carbide in an arc furnace. Then, chlorination produces a crude hafnium-zirconium tetrachloride that is fed to a hexone-thiocyanate solvent extraction stage. There the hafnium is separated from zirconium. Zirconium leaves this separation step as oxide, then is chlorinated to pure tetrachloride. Magnesium reduces $ZrCl_4$ to the metal. A vacuum distillation stage drives off magnesium chloride and delivers pure zirconium sponge.

► **Chief Variations**—Carborundum's flowsheet closely parallels this operation. But Mallory-Sharon introduces at least one significant variation. It uses sodium, rather than magnesium, to reduce the tetrachloride.

Unfold Flowsheet →



1 MIXING TANK solubilizes Hf-ZrCl₄ in water to produce zirconyl chloride for Hf-separation stage.



2 EXTRACTION COLUMNS: Countercurrent hex-one-thiocyanate solvent extracts hafnium.

And, though using the BuMines separation scheme right now, M-S has an option on an Australian hafnium-separation process that it may commercialize after current pilot plant studies are completed.

Columbia-National's variation start with the zircon sand. C-N fuses zircon with caustic soda, then separates zirconium from silicon as sodium zirconate. Furthermore, solvent extraction of hafnium is accomplished with tributyl phosphate after zirconate has been converted to zirconyl nitrate.

► **Making Crude Tetrachloride**—Wah Chang mixes dressed zircon ore with graphite, then charges it to an arc furnace. There silicon oxide is driven off and zirconium carbide produced. Charge is crushed and fed to a chlorinator.

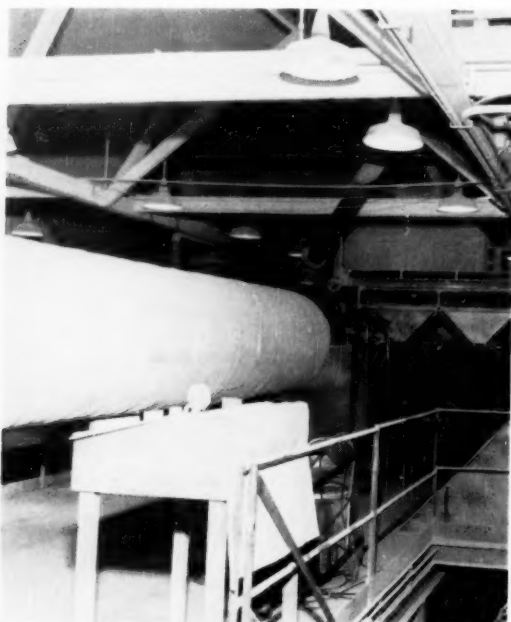
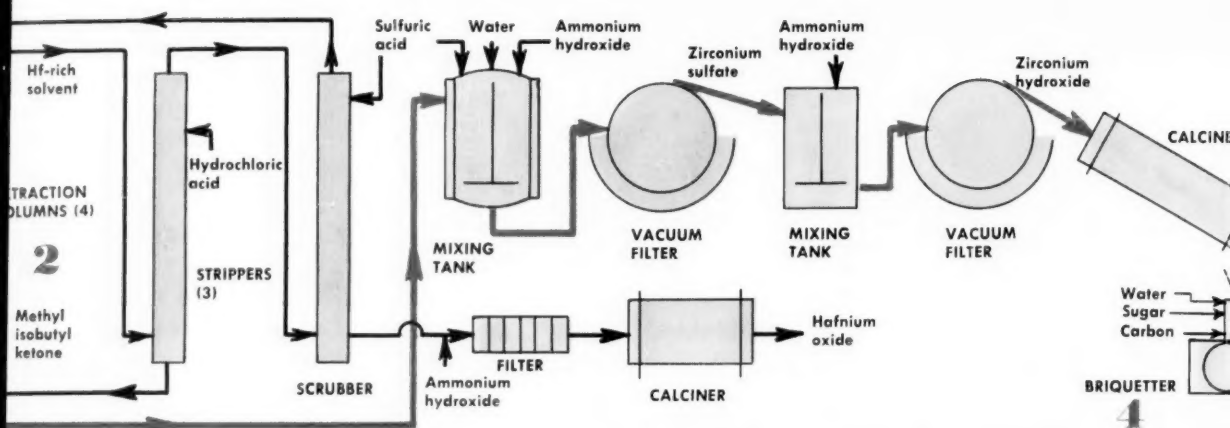
In this unit, a mild steel shell 54 in. dia. and 8 ft. high, chlorine passes up through the bed of zirconium carbide, producing crude Hf-ZrCl₄ vapor. Initially the

charge is heated with a carbon electrode, fitted vertically through the charge, to promote chlorination. Thereafter reaction proceeds without external heating. Reaction runs at 500-800 C. and 2 psi.

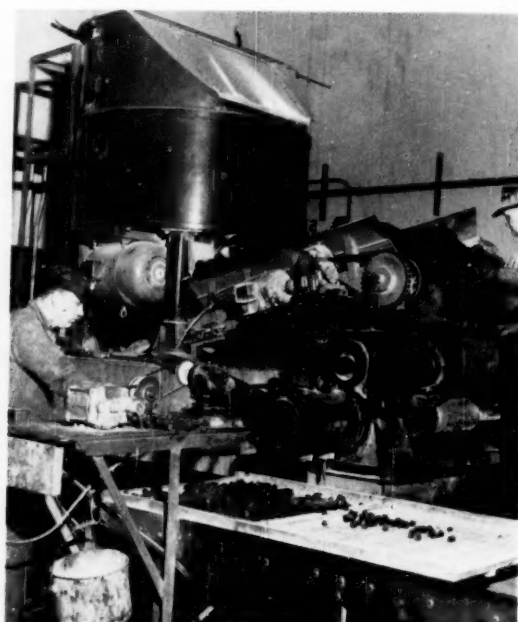
Tetrachloride vapor is collected in a water-cooled condenser as a solid. In the manufacture of reactor-grade zirconium, it then goes to the hafnium-separation stage. But this stage is bypassed in making commercial-grade sponge.

► **Solvent Extraction of Hf**—Crude tetrachloride is first solubilized in water in glass-lined, agitated, 500-gal. kettles to produce zirconyl chloride. Then, solution is pumped to the extraction system.

This stage consists of four glass, 6-in.-dia. by 25-ft.-high, open columns in series arrangement. Feed enters top of first against a countercurrent stream of thiocyanate-rich methyl isobutyl ketone. Solvent extracts hafnium, leaving aqueous solution of zirconyl chloride.



3 CALCINER, electrically fired to 800 C., converts Hf-free zirconium hydroxide to oxide.



4 BRIQUETTER: Carbon, sugar and water mix with oxide; extrusion press makes pellets.

Any zirconium still in solvent stream is then stripped out by countercurrent hydrochloric acid stream in three, 6-in.-dia. by 50-ft.-tall glass columns. Acid-zirconium stream recycles to the extraction columns.

Zr-free hafnium raffinate from stripping section is scrubbed with sulfuric acid in a 6-in.-dia. by 55-ft.-tall glass column. Scrubbed solvent recycles to the extraction columns and the aqueous solution of hafnium sulfate is neutralized with ammonium hydroxide. Fed through a gas-fired, unlined mild steel, 18-ft.-long by 18-in.-dia. calciner, hydroxide is converted to oxide.

► **To Pure Tetrachloride**—Zirconyl chloride from the extraction stage is mixed with sulfuric acid and ammonium hydroxide in 500-gal., glass-lined, agitated, steam-jacketed reactors. Zirconium sulfate precipitates at 200 F. and pH of 1.5. A 3-ft. by 6-ft., rubber-covered rotary vacuum filter delivers sulfate to an agitated tank where it's repulped with 28% ammonium

hydroxide to produce zirconium hydroxide. Separated from the ammonium sulfate in another similar rotary vacuum filter, hydroxide feeds through two 3-ft.-dia. by 30-ft.-long stainless steel, electrically fired rotary calciners operating at 800 C. There, pure zirconium oxide is produced.

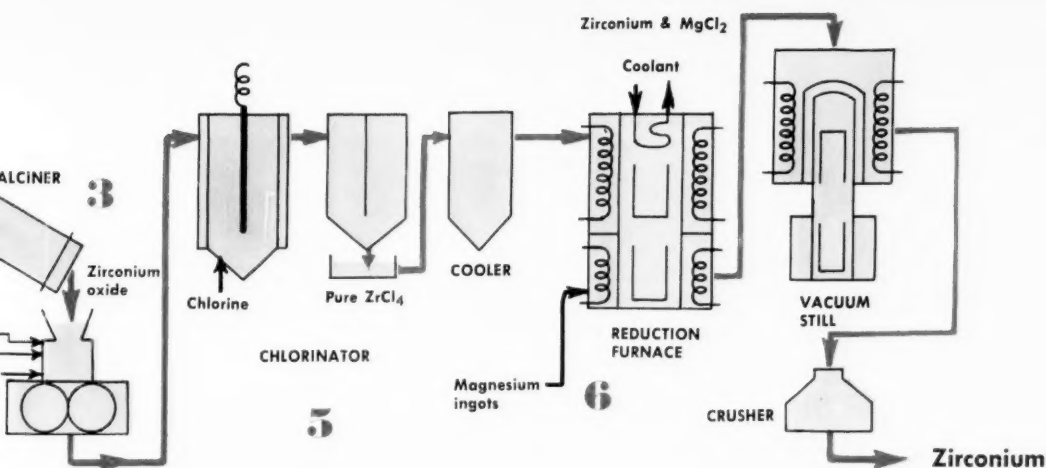
Lampblack, powdered sugar and water are mixed with the oxide in a ribbon mixer. An extrusion press forms the mix into rod-shape briquettes. These are charged to a 10-ft.-high by 6-ft.-dia., silica-lined steel chlorinator fitted horizontally with three graphite electrodes located half-way up the unit's sides and set 120 degrees apart.

Briquette bed serves as an electrical resistor. It's heated to about 800 C. by three-phase electrical power supplied by 500-amp. transformers. Chlorine gas enters through four inlets below the electrodes and passes up through the bed. Pure tetrachloride vapor

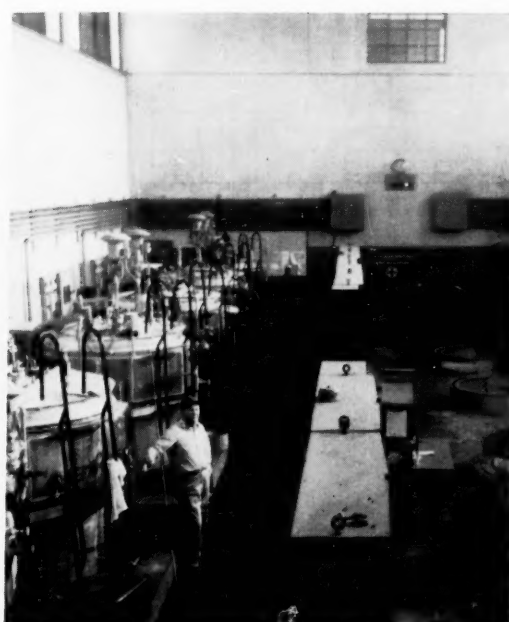
produces nickel-l... cyclone... Exhaust... atmospher...

► **Magn...** naces, v... tall and... ments, ... ing tetra... taining ... water a... fills it to...

Heating... 825 C. ... ZrCl₄ va... reacting... chloride...



5 CHLORINATOR: Cl_2 passes through briquette bed at 800 C., to convert oxide to ZrCl_4 .



6 MAGNESIUM REDUCTION of Hf-free tetrachloride takes place at 825 C. in furnace at left.

duced passes from the top of the chlorinator to a heli-line steel condenser where it crystallizes. A cyclone-type aftercooler completes condensation. Exhaust gases, scrubbed with caustic soda, vent to atmosphere.

Magnesium Reduction—Pit-type reduction furnaces, with retorts measuring 40 in. dia. by 105 in. and fitted with nichrome resistance heating elements, are charged with two crucibles. One, containing tetrachloride, is stacked on top of the other, containing magnesium metal pigs. Furnace is sealed, and aspirators evacuate unit and helium gas back to a pressure of roughly 1 psi.

Heating coils raise furnace temperature to about 825 C. Tetrachloride vaporizes and magnesium melts. ZrCl_4 vapor contacts molten metal in lower crucible, reacting to form metallic zirconium and magnesium chloride. Reaction is completed in about 40 hr.

► **Vacuum Distillation**—The zirconium-containing crucible, with MgCl_2 and excess magnesium metal still in it, is then loaded into a 40-in.-dia. by 10-ft.-high vacuum distillation retort. Upper portion of retort is enclosed in a bell-type resistance furnace and the lower portion is enclosed in a water jacket.

Crucible fits on a table in the upper portion in an inverted position. Vacuum pump reduces pressure in the unit to about 0.5 microns and furnace heats it to about 875 C. MgCl_2 falls away from the crucible into salt cans in the lower portion. Excess magnesium distills off, condensing on the water-cooled walls.

After about 40 hr. distillation is completed and the furnace is lifted off the retort. Helium is admitted to speed cooling. Then unit is evacuated and backfilled with dry air, evacuated again and refilled with atmospheric air. Zirconium, chipped from the crucible with a break-out press, is crushed to size for market.



**If Your Tubing or Piping Application Requires Corrosion Resistance
Here's The Plus The Job Needs...**

FULLY HEAT TREATED B&W STAINLESS STEEL

The resistance to corrosion of a given grade of stainless steel depends upon its heat treated condition. For instance—the austenitic grades of stainless steel, such as the 18-8 group, have optimum resistance to corrosion only when they have been heated to certain high temperatures which "dissolve" all the carbides and then are rapidly cooled to keep these carbides "in solution."

The illustration shows a B&W Stainless Steel Tube leaving the heat treating furnace. In a little over a foot of travel and in a couple of seconds, the temperature of the tube is reduced from around 2000 F. to one where the operator can place a bare hand on it without harm. This tube offers maximum resistance to general corrosion.

At B&W the heat treatments of all grades of stainless tubing are rigidly controlled. And the same type of controls are on *B&W Welded* as are on *B&W Seamless* stainless tubular products. And the same kind of specialized care is given to tubular products intended for distributor stocks as that

given to material intended for direct shipment to the user.

For virtually any application—pressure or mechanical—B&W can provide either seamless or welded stainless tubing in any number of grades, in a broad size range, and with the properties needed for optimum service life and ease of fabrication. For stainless steel tubular products—specify B&W and be sure.

The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.



TA-7007-PG4

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels

How Crane valves cut costs at Long-Bell



Four times longer valve life in corrosive creosote service

The scene is in the treating plant of the Long-Bell Division of the International Paper Company, at Longview, Washington. The valve in the line from hot well to creosoting retorts is a Crane Ni-Resist gate, installed in 1949.

However, back in 1947, another make valve of the same type was used here. But it was an early victim of corrosion from the creosote and light oil vapors present. It began to leak in less than a year, and had to be replaced with this Crane valve after 18 months.

In contrast, the Crane Ni-Resist valve resisted leakage for 6 years, until its disc was

corroded in 1955. Even then, only the disc was replaced, and the original valve is still in service.

Combined with Crane design and workmanship, Ni-Resist alloy cast iron with 18-8 S Mo trim provides the most economical valves for many process industries. They have substantially greater resistance to corrosion, erosion and wear than ordinary cast iron valves, yet cost very little more.

Look into these valves with your Crane Representative, or write to Crane Co. for Circular AD-2047.



CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

CHEMICAL ENGINEERING—January 13, 1958



●

Raymond

ROLLER MILL

with
**Whizzer Separation
and
Flash Drying**



DYNAMIC MODERN DESIGN of the Raymond Roller Mill gives you important new economies in production of fine chemicals, pigments and many non-metallic minerals.

This complete pulverizing unit combines: Whizzer separation with simplified fineness control . . . pneumatic feed control to maintain maximum mill capacity . . . self-lubricating roller journals for reducing lubrication costs . . . throw-out attachments for rejecting impurities; also for making two grades simultaneously: granular product with a minimum of fines and the normal finely divided product from the cyclone collector.

The Mill serves a double purpose when built with integral Flash Drying accessories for removal of surface moisture while pulverizing. By the same system, fresh air may be introduced into the mill for cooling action . . . or a neutral gas used with special equipment as in the grinding of sulphur.

The ease of installing the Roller Mill to fit an existing plant layout, its flexibility in application, its automatic dust-free operation with a record low cost of maintenance, make the Raymond Roller Mill a sound investment for modern plants.

Typical set-up of Roller Mill with piping, collectors, and package type furnace for supplying heat to system for Flash Drying.

Tell us your pulverizing requirements. Raymond engineers can determine what the Roller Mill can accomplish for you by running laboratory tests on your material. Catalog will be sent on request.

COMBUSTION ENGINEERING, INC.

Raymond Division

1311 North Branch St.
CHICAGO 22, ILLINOIS

SALES OFFICES IN
PRINCIPAL CITIES

Combustion Engineering-Superheater Ltd., Montreal, Canada

Chemical Engineering

Practice

JAN. 13, 1958

Department Index

Process Flowsheet.....	128
Feature Report	137
Feature Articles	145
Plant Notebook	164
Flow File	170
Corrosion Forum	172

Zirconium rises to the chemical big time... TURN BACK TO 128

Spurred on by its almost matchless utility in nuclear reactors and its excellent corrosion and temperature resistance, zirconium is now no longer a lab curiosity.

Chemical process highlights of '57..... 137

What the chemical industry contributed last year from direct-iron ore reduction to directed catalysis and semi-conductors to high-temperature materials.

How to select the proper ejector..... 145

Because of the increased use of vacuum operations, today's steam-jet air ejector has an important role in the production of high vacuum. Here are the facts.

Not by cost alone..... 151

Don't rate process economic factors by cost alone. For a more profitable operation, you'll do better to gage their relative importance via this new technique.

H₂ O₂ now shine in a new light..... 155

As the coming age of rockets and missiles throws a spotlight on vital new uses. Good idea to bone up on its physical and thermodynamic properties in the pure state.

Now... a safe way to size rupture disks..... 157

You can calculate adequate vent capacity to protect valuable equipment from rapid pressure rise caused by unforeseen explosions. Here's how to do it.

To get latent heat of phase change..... 159

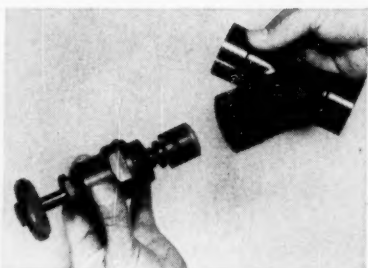
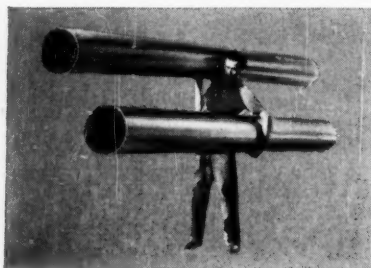
You can start even with meager data, stretch it out and then estimate for the heat of vaporization, fusion or sublimation—by using these valuable methods.

Ni plates tough-to-plate parts..... 172

This new chemical process—Niphos by name—uses a furnace-reduction technique to plate a uniform nickel coat on complicated parts, impossible to electroplate.

PVC stops corrosion

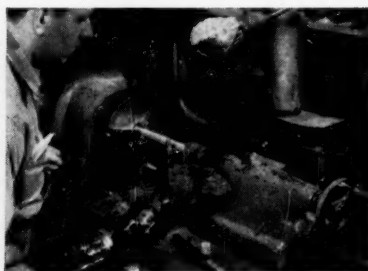
(POLYVINYL CHLORIDE)



Ryertex-Omicron PVC is an exceptionally versatile industrial plastic with outstanding resistance to 281 corrosive solutions and gases. Its light weight (only 1/6 that of steel) and its

great strength are but two of its money-saving advantages. It is nontoxic, noncombustible, nonmagnetic and nonsparking. It is immune to weather, rotting and aging.

PVC comes in the forms you need



You can choose PVC pipe in sizes from 1/2" through 14". Valves, flanges and fittings are precision-made by injection molding. Bars and sheets are fully extruded, not laminated.

The techniques of fabricating PVC are similar to those for metal. PVC can be cut, drilled, formed, bent, welded, threaded and machined ... is easy to assemble and install.

A new way to cut costs

Application possibilities are virtually endless. New uses for PVC are being discovered nearly every day. A Ryerson plastics specialist will be glad to help you find out where you can cut costs with this remarkably efficient material. Phone or write your nearest Ryerson plant—now! Send the coupon for our PVC booklet.

RYERSON STEEL
INDUSTRIAL PLASTICS AND BEARINGS DIVISION

Free booklet!

Joseph T. Ryerson & Son, Inc.
Box 8000-A, Chicago 80, Illinois

Please send me a free copy of your PVC Bulletin 80-3.

Name _____

Company _____

City _____ Zone _____ State _____



JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI • CLEVELAND
DETROIT • PITTSBURGH • BUFFALO • INDIANAPOLIS • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE



FOR 1958:

26 Times . . . and Better

With this first issue of 1958, *Chemical Engineering* increases its publishing frequency to 26 times a year.

And with this first issue of 1958, CE comes to you *streamlined* to speed up the communication of engineering ideas and techniques . . . *expanded* to serve the chemical engineer—as an engineer—in whatever capacity he may function . . . *designed* to match the pattern and pace of today's practice of chemical engineering.

. . . 26 issues a year—every two weeks instead of once a month as before—will speed up communication of timely processing developments and engineering methods.

. . . almost 30 percent more editorial pages in the coming year will broaden coverage of basic technology in petrochemicals, nuclear processing, instrumentation . . . in all processing fields.

. . . 22 industry-experienced editors—of which 19 are engineers—will deepen coverage in production, design, development . . . in all engineering functions.

. . . streamlined issues, with tighter editing and functional display, will quicken your reading and comprehension . . . make it easier to spot your interests.

. . . three brand new departments to be added within the next 12 months will pinpoint more engineering trends and techniques in research, design, plant maintenance . . . wherever chemical operations are used.

At first glance, the 1958 CE will not look much different. Our extensive surveys on what chemical engineers want in their engineering magazines—conducted on a continuing basis for almost nine years—show that striking changes in format are not the answer to better service, that the essence of progress lies much deeper . . . in integrated coverage, timeliness, accuracy, interpretation, breadth and depth of the editorial base.

We are confident that these moves will give you—all our readers—greater values from our editorial pages during the coming year.

For 1958: 26 times . . . and better!

John R. Callahan

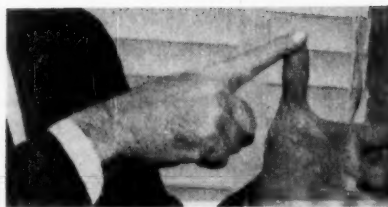
10

TOP

TECHNICAL TRENDS OF THE YEAR



Here are the editors'
choices of the ten
most significant
technological trends
in process industries
during the past year.



Uranium Production Leads Field in New "Chemical Metallurgy"

With chemical engineering methods penetrating deeply into extractive metallurgy, uranium leads as resin-in-pulp and continuous ion exchange vie with solvent extraction.

THE chemical engineer's increasingly effective contributions to the extraction and refining of the "atomic age" metals ranks as one of the outstanding technological trends of the postwar era. This trend culminated last year in the decision of the country's senior chemical engineering educators to recognize some 75 organizations in industry and government for pioneering applications of chemical engineering principles and processes in "chemical metallurgy."

At the top of the list of atomic metals, of course, is uranium. Within a short ten-year span, pros-

pectors, investors, miners and millers, as well as engineers, have wrought a billion-dollar uranium-producing industry.

Early U. S. mills could handle only 100-200 tons/day of ore; they were mainly vanadium mills revamped to turn out byproduct uranium concentrate by precipitation methods. Most of the newer mills process from 500 to 3,000 tons/day of ore, using the latest techniques of ion exchange or extraction.

While three mills still use the older precipitation methods to recover uranium from purified leach liquors, they are handicapped by large consumption of reagent chemicals, incomplete precipitation and loss of valuable uranium with the plant effluent.

Uranium recovery via ion exchange appeared on the scene about five years ago, following the discovery that uranium complexes could be extracted selectively from sulfuric acid solutions with anion-exchange resins, rather than extracting uranium ions with cation-exchange resins. Initial applications used fixed beds of resin in columns.

Just two years ago, however, Anaconda put into operation the first resin-in-pulp plants at Grants, N. M. In this process, baskets of resin are dipped up and down in the unfiltered, leached pulp, thus eliminating the costly, troublesome filtration step. RIP has caught on fast; six mills now use it.

First truly continuous, commercial-scale counter-current ion exchange recovery of uranium has just reached full output after startup last fall at Union Carbide Nuclear's Maybell, Colo., plant. Working on either clear liquor or pulp, the system saves capital, operating and maintenance costs. Resin and pregnant pulp or liquor flow countercurrently through a series of exchange or elution contactors adapted from Inflico's Aero-Accelerator.

Another chemical engineering technique, now vying with ion exchange for the uranium-processing spotlight, is solvent extraction. First to apply this process to sulfuric acid leach liquor was Kerr-McGee, who put its unit at Shiprock, N. M., on stream 15 months ago. Two other mills followed suit during 1957. According to Kerr-McGee, a solvent extraction system costs approximately one-third as much to install as an equivalent ion exchange unit. It's easy to operate and competitive on cost of reagent.

Typical solvent system is di-2-ethyl hexyl phosphoric acid plus tributyl phosphate in kerosene. TBP prevents formation of a third phase during stripping (usually done with soda ash solution), also boosts extraction power of the solvent through a synergistic effect. Other synergistic agents, such as phosphonate compounds (characterized by the now-available dihexyl hexane phosphonate) seem destined for early adoption because they increase the extraction coefficient many-fold.

Several variations on the solvent extraction theme may emerge from their present experimental status to make this technique competitive with RIP ion exchange in elimination of the filtration step. One scheme is solvent extraction of leached pulp. Another is "solid solvent extraction," in which activated carbon, loaded with an adsorbed solvent, is the extraction agent. A third is direct solvent leaching—percolation of a mineral acid-solvent-diluent through the ore on a pervious moving belt.



Steel Industry Exploits Hydrogen

Hydrogen plus chemical engineering is doing several steel industry jobs. Most striking is direct iron-ore reduction in fluid beds.

FUSION of chemical and metallurgical technologies is the trend not only in the production of "atomic age" metals but also in the venerable steel industry. Chemical engineers are contributing their ideas and talents all along the line, from iron ore beneficiation to improvement of byproducts.

Hydrogen figures prominently in several of the steel industry's chemical engineering developments which were in the spotlight during 1957. Foremost among these is hydrogen reduction of iron ore in fluidized beds.

Greatest progress, judging by published reports, was chalked up by Hydrocarbon Research, Inc., and Bethlehem Steel, joint developers of a process that uses hydrogen from a partial-oxidation unit to reduce iron ore fines at about 900 F. and 400 psi. This work culminated in the announcement late in the year that Alan Wood Steel Co. had ordered a 50-ton/day unit which would be used to produce iron powder at Ivy Rock, Pa., for the powder metallurgy market.

HRI proved out its process in an experimental unit at Trenton, N. J., using a reactor 34 in. I.D. by 30 ft. high. Other groups were also running similar pilot plants last year—e.g., U. S. Steel at Chicago and Arthur D. Little, Inc., at Cambridge, Mass. USS also uses hydrogen, but employs higher temperatures and lower pressures (1,100-1,700 F. and 15-30 psi.) than HRI. ADL, with a two-stage pilot reactor 12 in. I.D. and 30 ft. high, uses methane as reducing agent.

Main attraction of fluid-bed iron ore reduction is its relatively low capital cost compared with the traditional blast furnace. In addition, fluid-bed units may be practical in small sizes. But savings in operating costs will depend largely on the price of the gaseous reducing agent.

In another, markedly different, way chemical engineers last year were putting hydrogen to work for the steel industry. This was the hydrogen treating of coke-oven aromatics (benzene, toluene, xylene) as a means of achieving higher purities and meeting competition from petroleum-derived B-T-X.

First two such operations in the U. S. reached commercial stature during 1957. Jones & Laughlin brought in a 55,000-gal./day installation at Aliquippa, Pa., using a modification of Esso's Hydrofining process. And U. S. Steel now has a 150,000-gal./day operation at Clairton, Pa., based on a Koppers-engineered German process. Both plants

use a Udex solvent extraction system to separate the aromatics from nonaromatics in the light oil.

Over in England, meanwhile, the Coal Tar Research Assn. was putting through a pilot plant its own version of hydrogen refining of benzene. Backers claimed shorter contact, lower pressures.

Despite differences in details, the hydrogen refining processes all employ the same basic idea. Crude light oil is reacted with hydrogen in the presence of a catalyst (metallic oxide or sulfide) to convert unwanted sulfur compounds into hydrogen sulfide. Coke-oven gas (45-55% H_2) can be used instead of hydrogen, but at a higher operating pressure; partial pressure of H_2 is the important thing.



Semiconductors Point to Gains in Both Production and Use

With germanium purification substantially conquered, two large germanium rectifier installations are operating.

A GAINST a background of continued rapid growth in sales of semiconductor devices, 1957 chalked up several notable developments in both their metallurgy and their application.

Number of producers of the newer of the two commercial semiconductor materials—hyperpure silicon—increased from two to eight. The first two large-scale installations of germanium rectifiers started up, both for chlorine production. With germanium purification just about licked, manufacturers came to closer grips with attainment of the still higher purity needed in semiconductor silicon.

Two of the new silicon producers claimed less than one part impurity in 6 billion parts of silicon—6 to 18 times better than competing claims. Progress toward making of higher-frequency devices was furthered by the new Bell Laboratories diffusion process which gives better control in the addition of impurities to silicon and germanium to form semiconductor junctions.

Possibility that chemical compounds may become the semiconductor materials of the future, rather than single-element materials like silicon and germanium, is suggested by GE's announcement of a silicon carbide rectifier which has operated at temperatures as high as 1,200 F. Silicon's best previous operating range has been 400-500 F.

Diamond Alkali, at Deer Park, Tex., uses one of the two new germanium rectifier installations on a load of 52 De Nora cells of 120,000 amp. each. With mercury-arc rectifiers, which operate efficiently in the 600+ voltage range, about three times as many 40,000-amp. cells would be needed to produce the

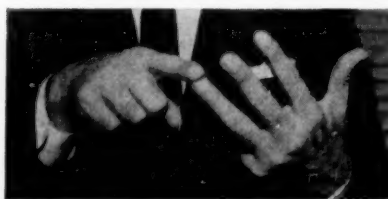
desired over-all voltage drop. At Deer Park, the voltage drop across the 52 cells is less than 250.

It seems likely that germanium rectifiers will continue in demand where large quantities of low-voltage direct current are required. Germanium junctions are good for about 100 v., and no more than two can be efficiently connected in series. In contrast, single silicon junctions can produce up to about 300 v., d.c., for higher-voltage applications.

Purity has been the problem in semiconductors. Greater purity would increase reliability of existing devices and make new ones possible. In germanium, impurities no longer interfere when there is one atom impurity per 10^8 atoms germanium. With silicon the ratio is $1/10^{12}$, obviously a long way from the best $1/(6 \times 10^8)$ ratio announced by newcomers Merck and Westinghouse. With only Du Pont and Sylvania initially in the hyperpure silicon field, last year also saw the entry of Bell Labs, W. R. Grace, Eagle-Picher and Texas Instruments.

Besides its need for higher purity, silicon's greater affinity for its impurities makes it harder to purify than germanium. Where Bell Labs' carbon-crucible zone-refining process worked beautifully for germanium, it would give carbon contamination of silicon. Heretofore the best commercial compromise has been to use quartz containers, but Bell Labs' new automatic floating-zone refining process does away with containers entirely.

Here a solid rod of material to be purified moves repeatedly past a heating zone. Impurities dissolve preferentially in the melt and are swept to one end.



Technology Puts the Heat on Construction Materials

Rockets, missiles, high-temperature process uses are demanding better materials. Both metals and non-metals are showing the way.

N EED for better materials for high-temperature service became acute last year as the programs in rockets, missiles, aircraft and nuclear energy took on still higher priority. High-temperature chemical processing gained in urgency, too. Materials to withstand temperature levels above 1,200 or 1,500 F. are therefore on the march.

It is unfortunately true that high-temperature materials suitable for rockets, since they need only a short life, are often of little use for high-temperature industrial service. For example, many materials that are ordinarily considered only for low-temperature applications—such as plastics—stand up well for short-time high-temperature use.

Molybdenum has now become available in com-

mercial sizes and shapes. Outstanding in its high-temperature strength, it does oxidize catastrophically at temperatures over 1,200 F. The problem is to devise a protective coating to prevent this, but efforts have been unsuccessful so far.

Columbium (niobium), the atomic-energy-spawned metal, is now in the high-temperature limelight. While it also oxidizes, the rate is only 5% that of molybdenum; the oxide is adherent and non-volatile, so that columbium and its alloys appear to be headed for the 1,800 F. range.

Among high-temperature nickel alloys is the new nickel-chromium-iron-titanium alloy, Incoloy-T, which comes in sheets for temperatures to 1,400 F. Two striking high-temperature developments were announced in the ceramic field. Corning's Pyroceram, a crystalline "glass" family of ceramics, is said to be harder than high-carbon steel, lighter than aluminum and nine times as strong as plate glass. It differs from glass in being crystalline and from other ceramics in having a much finer crystal structure.

Pyroceram is melted and formed like glass and can be shaped while molten by conventional glass-forming processes. Batch materials are inexpensive. It is expected to be more costly to produce than glass, but a good deal cheaper than alloys such as stainless steel. It is said to be outstanding in its resistance to corrosive agents at high temperatures.

Secret of the unusual properties of this material seems to lie in the use of one or more nucleating agents in the melt. After forming, the material is heat-treated so that the nucleating agents form sub-microscopic crystals, each acting as a center of crystal growth. Control of batch composition and crystal growth permits tailoring to suit.

Numerous uses for Pyroceram can be envisioned, not only in high-temperature, corrosive process service, but probably in missiles and jet engine parts as well. More prosaic applications may include architectural curtain walls and cooking ware.

Two years ago a team of GE scientists applied high temperatures and extreme pressures in the production of the first practical man-made diamonds. By somewhat similar techniques the same team has now produced Borazon, a cubic boron nitride made at pressures over 1 million psi. and temperatures above 3,000 F. This development opens up exciting possibilities for the use of similar techniques in the synthesizing of other high-temperature materials that don't exist in nature.

Borazon's unusual properties come from its crystal structure, which differs from that of ordinary boron nitride. In the latter the structure is hexagonal, with the crystals spaced farther apart than in the cubic Borazon. Here, alternating atoms of boron and nitrogen are packed together almost as closely as the carbon atoms in diamond. Borazon and diamond can scratch each other, but Borazon withstands temperatures to 3,500 F. and more—twice as great as diamond.

The initial samples of the new nitride were tiny crystals of black, dark brown or red coloration, and first applications are likely to be in industrial grinding, cutting and polishing tools. Recalling the principle of "What good is a baby?" nobody can yet predict how far this development may go.



High-Energy Fuels Head for Stratosphere

Boron-based chemical fuels are big news in military aviation today. However, solid propellants may gain preference in missiles.

NINETEEN hundred fifty-seven takes its place in history as the year that man flung open the gateways to the infinite reaches of outer space.

Russia startled the free world when it hurled Sputnik I into its celestial orbit. The missile and satellite program in this country vaulted to a position of priority surpassing, at least in financial support, the atom bomb Manhattan Project.

Challenged by these developments, chemical engineers faced the vital task last year of producing fuels and propellants packing a more furious punch than that offered by usual liquid and solid fuels.

The boron-based chemical fuels generated the most widespread interest and activity. Callery Chemical broke ground in March at Muskogee, Okla., for a \$38-million alkyl boranes plant, for the Navy, due on stream by this year's end. In June, Olin Mathieson put into operation a privately financed, \$5.5-million semicommercial high-energy fuels installation at Niagara Falls, N. Y. A scant month later, it started construction on a \$36-million Air-Force-financed plant at nearby Model City, N. Y. Startup is slated for early 1959. And before the end of 1957, OM had swung on stream a \$4.5-million interim facility for the Navy.

Makers of intermediates for the boron fuels were equally busy. In September, Metal Hydrides, with its \$9.2-million Navy contract, brought into operation a \$5.5-million sodium borohydride plant at Danvers, Mass. Stauffer Chemical completed a boron trichloride unit at Niagara Falls earlier in 1957.

All this activity is just a beginning. Predicts one industry-wise observer, "These fuels will become a billion-dollar industry within ten years."

Attraction of the boron propellants stems from the fact that upon burning they release about 1.5 times as many Btu./lb. as do petroleum hydrocarbons. Hydrogen, with its matchless heat release but with its discouraging handling problems, is locked in a more easily handled form with high-heat-release boron. Lightweight combustion products also contribute to a high specific impulse (which is directly proportional to the square root of combustion chamber temperature and inversely proportional to the square root of molecular weight of combustion products).

However, the borane molecules themselves pose some handling problems and are rather unstable. Tacking on an alkyl group (e.g., ethyl) goes a long way towards easing these conditions.

Exactly how these alkyl boranes are made has remained under government wraps up to now. But, essentially, here's what's involved: An alkali-metal hydride or borohydride is reacted with a boron halide to form a borane. Then a metal alkyl reacts with the borane, producing alkyl borane.

Stature of solid propellants increased last year, with the prediction by some authorities that high-energy solid fuels would eventually prove to be the preferred propellants for long-range missiles. Underscoring last year's interest in solid propellants were Thiokol's new privately owned facility at Brigham City, Utah, and plans of Hooker and Foote Mineral for joint manufacture of perchlorates.



Fuel Cell Converts Gases to Electricity

Long the dream of efficiency-conscious engineers, fuel cells may be on the verge of commercial success. The Army is now using them.

ANY energy-conversion process making use of a heat engine has its theoretical thermal efficiency limited to that of the Carnot cycle. Hence fuel cells, which convert fuel energy direct to electricity without an intervening heat engine, have long been an attractive idea to inventors.

During 1957 National Carbon Co. announced a major breakthrough in fuel cell conversion of hydrogen and oxygen to electricity. Developed to provide the Army with a completely noiseless generator for portable radar sets, success came with the perfection of a specially catalyzed porous-carbon electrode. Banks of electrodes are sealed in a container holding KOH electrolyte. When oxygen is diffused through the positive electrodes, hydrogen through the negative, a 1-v. potential difference is set up, enabling a current to flow through electrolytic action.

Thus, as long as the two gases are supplied, the cell produces current, with a byproduct of water which is discharged by evaporation. Over-all efficiency is about 65 to 80%, compared with 35% for the best heat engines. Output is 1 kw./cu. ft. of cell volume. National Carbon believes that use of higher operating pressures (e.g., 150 psi. rather than 1 atm.) might up output to 10 kw./cu. ft.

Although the O_2 - H_2 fuel cell would seem to have a wide range of potential uses, National Carbon is conservatively awaiting developments before making plans for development of non-military markets.

Any large-scale future use of the O_2 - H_2 fuel cell would depend, of course, on availability of cheap hydrogen. London Transport Authority is understood to be considering the possibility of using fuel cells to carry electric-railway peak loads, generating

the H_2 and O_2 with offpeak power. Several other ideas, probably quite far in the future, might be able to provide hydrogen for competitive power.

One idea would be to use atomic reactors to decompose water—at present an unwanted property. This would sidestep the steam cycle and up the efficiency. Another would be to use the sun's ultra-violet radiation to decompose water, thus solving the problem of storing solar energy at night.



Pipe-Dream Comes True: Pipelines Now Delivering Solids

Commercial use of one 72-mile slurry pipeline and experimental use of another 108-mile line mark a future trend in solids transport.

WITH energy supply one of the most vital of today's problems, it is not surprising to find fuel transport being subjected to study, along with the energy sources themselves. A potentially significant approach to cheaper fuel delivery is the slurry solids pipeline, which received two large-scale try-outs last year.

Both of these pipelines are handling solid fuel materials—one, gilsonite destined for conversion to gasoline, fuel oil and coke; the other, bituminous coal for use in a utility plant. But if the method works out, it is likely that other non-fuel minerals will also be transported by pipeline in the future.

American Gilsonite's 6-in. slurry pipeline is in actual commercial use, transporting 700 tons/day of minus 8-mesh gilsonite as a suspension of roughly 35% in water. Plunger pumps operating at 2,000 psi. force the slurry through the 72-mile line and over a mountain pass 2,700 ft. above the pumping station at the mine head.

The gilsonite pipeline represents a solution to a severe transport problem posed by terrain. However, the pipeline traverses country which is no more difficult than has already been conquered by oil pipelines. The alternate truck route is 110 miles longer. With the coal pipeline, however, the problem is to reduce the cost of freight haul, which will doubtless motivate other solids pipeline uses.

Pittsburgh Consolidation Coal Co.'s coal pipeline, now being tried out for delivering 14-mesh bituminous coal to Cleveland Electric Illuminating Co. 108 miles away, is designed to handle 3,600 tons/day. Plunger pumps at the mine and at the 30- and 60-mile points maintain a pressure of 1,000 psi. Since the density of coal is much more than that of gilsonite, it is necessary to carry a considerably higher flow velocity than the 3.4 fps. used for gilsonite.



Soaring Demand for Liquid Fuels Gets Assist From Fuel Solids

Though Fischer-Tropsch is economically out in U.S., other solid-to-liquid fuel processes are getting, or are about to get, a real trial.

PRODUCTION of liquid hydrocarbon fuels from non-liquid feedstocks has blossomed into large-scale reality. Chemical engineers last year:

- Put finishing touches on the SASOL Fischer-Tropsch plant for producing liquid fuels from South African coal.
- Brought on stream in Colorado a unique refinery for making gasoline from gilsonite solids.
- Began operation of a 300-ton/day experimental retort in an effort to prove out the economics of a Colorado shale oil industry.
- Undertook design of a large-scale plant for coaxing oil from Alberta's rich Athabasca tar sands.

Meanwhile, down in Brownsville, Tex., the ill-starred venture originally known as Carthage Hydrocol began grinding to a halt as Amoco Chemicals, its present owner, tagged the natural-gas-based Fischer-Tropsch operation a technical success but an economic failure.

In retrospect, it appears that the Brownsville operation was doomed almost from its conception by skyrocketing demands for natural gas as a premium domestic and commercial fuel. Fischer-Tropsch synthesis just can't compete with liquid petroleum in the U.S. economic picture today.

In contrast, the South African economic situation seems to be made to order for successful liquid-fuel synthesis. The SASOL plant sits over a coal mine, gets its raw material (from seams more than 20 ft. thick) at a delivered cost of 60 cents/ton. And the plant is located several hundred miles inland, near the Johannesburg marketing area, competing with imported petroleum fuels.

American Gilsonite Co.'s new operation in western U.S. also contains the ingredients basic to economic success. The solid hydrocarbon mineral, gilsonite, is mined hydraulically at Bonanza, Utah, and transported as a slurry 72 miles via pipeline (*see above*) to provide the refinery at Fruita, Colo., with a feedstock costing less than \$2/bbl.

Solid gilsonite is converted into gasoline by melting it to a liquid hydrocarbon, charging it to a conventional delayed coker, catalytically reforming the coker overhead with the aid of makeup hydrogen generated from byproduct LPG. High-octane product has a ready market in the Colorado-Utah area. Coke is calcined into a premium, electrode-grade product for shipment to the Pacific Northwest's aluminum industry.

At Grand Valley, less than 100 miles from the gilsonite refinery, Union Oil was putting through its paces a \$1.5-million prototype oil shale retort with a capacity of more than 300 tons/day of shale. Union aims to find out whether this retort can recover oil from rock shale at a cost which, extrapolated to large-volume operation, would make the entire process of mining, retorting and refining competitive with production of petroleum crude oil. And over in Denver the Aspeco shale oil process—based on solid-solid contacting of shale with heated grinding balls—was getting a 25-ton/day tryout.

On still another front, Royalite Oil Co. engineers were working on plans for a \$50-million commercial development program for unlocking the hydrocarbon wealth of the Athabasca tar sands. Most likely processing scheme involves mining the sands, diluting with a light oil, separating the sand from the liquids centrifugally and refining the oil.



Directed Catalysis Improves Organics

From xylene oxidation to a variety of polymer developments, better understanding of catalysis is paying off in simplification of processes, higher yields, new products.

IN THE petrochemical field, Amoco Chemicals is betting heavily that a new xylene oxidation process will restore some of the prestige—and money—lost in its unsuccessful Fischer-Tropsch venture (*see above*).

The wager: A \$10-million plant at Joliet, Ill., due on stream late this summer. The process: Scientific Design's one-step, liquid-phase air oxidation of aromatic hydrocarbons. The prize: 60 million lb./yr. of phthalic, isophthalic, terephthalic and benzoic acids for rich markets in paints, plastics and fibers.

Overseas, too, the SD process has its backers. France's Pechiney, Japan's Mitsui Petrochemical and Maruzen Oil have bought licenses.

Beauty of the process lies in its ability to oxidize xylene isomers—singly or in a mixture—to their respective phthalic acids in one pass. This would seem to give it an inherent simplicity, flexibility and economy unequalled by any other known xylene oxidation technique.

Only the sketchiest information on the Scientific Design process is available. But patent data suggest use of bromine with a heavy metal catalyst, oxidation temperatures on the order of 200 C. and pressures of 200-400 psi.

On the polymer front, last year was a triumphant one. The first commercial low-pressure polyethylene

in the U. S. came on stream. (Capacity at year's end stood at 200 million lb.) Pilot plants for production of polypropylene got under way in Italy (Montecatini) and West Germany (Hibernia). The natural rubber molecule (polyisoprene) was synthesized on pilot-plant scale by Firestone, Goodyear and Goodrich-Gulf Chemical. DuPont announced plans for commercializing Delrin acetal polymer. And a new family of plastics, the polycarbonates, was disclosed by General Electric, Eastman Kodak and Farbenfabriken Bayer.

All the polymer developments have this in common: A "directed" polymerization, a precise orientation of monomers under the influence of complex organometallic catalyst systems. Low-pressure polyethylene has a more linear, more crystalline structure than does the conventional high-pressure variety. Polypropylene and other polyolefins in the development stages are essentially crystalline in makeup. The trick in natural rubber synthesis is proper orientation of isoprene monomers in the final polymer. And polycarbonates are polyphenols linked in linear fashion by short, sterically strong carbonate groups.



Maintenance Zooms as Automation Gains

Process industries are finding that maintenance is becoming indistinguishable from operation. In some plants maintenance men already outnumber operating personnel.

ALTHOUGH it's not exactly parallel to the other technological developments of this rapidly changing era, the zooming importance of maintenance as a part of the operating function is actually a sort of composite of many of them. Maintenance personnel are responsible for a sizable part of the production cost load; in some process plants they have even become more numerous than those in operation.

Not so long ago, maintenance was usually regarded as an unwanted stepchild in chemical process plants. Now the spread of automatic control and continuous processing has changed all that. In a recent survey of 226 industrial plants in ten major categories, *Factory Management & Maintenance* magazine found that the group comprising 35 chemical, petroleum and rubber plants had the highest percentage of maintenance personnel and the lowest percentage of operating personnel of any of the groups surveyed.

The chemicals group, with nearly 21% of all production personnel in maintenance, was followed closely by the other two process groups surveyed—pulp and paper, and stone, clay and glass. At the

same time, the chemicals group had the highest percentage of supervisory and specialized staff personnel of any of the groups.

Remember, these are averages. In highly developed continuous-flow process plants the position of maintenance may be still more marked. Du Pont's experience since 1940 has shown that, among hourly workers, the number of maintenance personnel increased 170% while other operating personnel were increasing by only 25%. At Du Pont's Sabine River Works, Orange, Tex., the maintenance roll already exceeds the operating roster by more than 20%.

This trend will continue. Maintenance to an ever greater extent is becoming a prime part of the operating function—in fact, maintenance and operation are tending to become indistinguishable.

The consequence is that trained maintenance supervisory personnel and skilled maintenance workers are at a premium. One solution will be the upgrading of operating personnel as their services become less necessary in actual operation. Another, now emerging in a tentative way, is contract maintenance. Here, specialized organizations take over certain maintenance functions on a contract basis. Examples include the maintenance of electrical equipment and instruments and general plant equipment, and the cleaning of fluid-flow and heat-transfer equipment, distilling columns, tankage and the like.

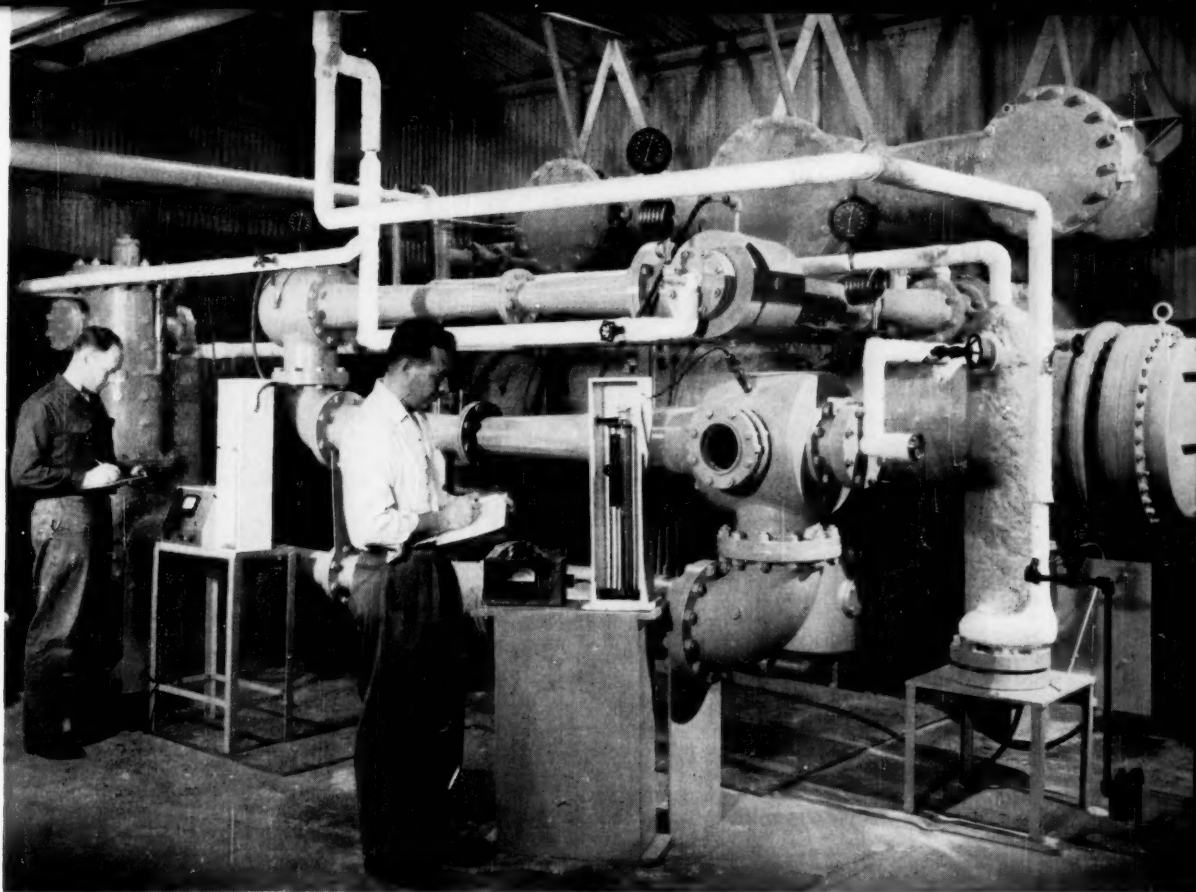
Why has all this come about? Primarily, the cause is the continued substitution of horsepower for manpower. Mechanization is the underlying factor, with automation an important extension of the mechanization principle. Equipment is becoming more complex, and the capital investment per worker is constantly increasing. In many processes, operation has become largely instrument watching, aimed at the two-fold purpose of detecting instrument malfunctioning and of balancing the various instrument loads for the optimum in process performance.

But as we move into the just-emerging era of computer control, self-checking instrument circuits will tend to obsolete the first function of the operator, while the computer will optimize the instrument relations more effectively than the man.

Equipment reliability—and to an ever increasing degree, instrument reliability—is thus becoming a paramount factor in operating profits. Although equipment and instruments are constantly being improved through better design and better construction materials, reliability is becoming immeasurably more necessary owing to the integration and cascading of process functions.

Since 100% reliability can never be attained, emphasis on the prevention of failure—rather than breakdown and repair—is becoming the order of the day. Where preventive maintenance was formerly only a pious word in most plant lexicons, it is now becoming the key to operating continuity, cost reduction and an acceptable return on investment.

As production costs continue to rise and the factor of competition becomes still more compelling, we can expect that maintenance will take its place as an integral part of operation, and will be recognized as parallel to development, design, construction and operation in the range of chemical engineering activities.



SIX-STAGE EJECTOR handles 8,000 cfm. at 10 microns. First four stages are shown.

Selecting Ejectors for High Vacuum

Here you'll find many uses of high vacuum techniques; also data on steam and water requirements, equipment costs and performance characteristics for steam ejectors having four or more stages.

C. G. LINCK, Graham Manufacturing Co., Inc., Batavia, N. Y.*

Today's steam-jet air ejector has an important role in the production of high vacuum largely because of the increased use of vacuum operations.

Five-stage ejectors are now offered by a few manufacturers for operation at absolute pressures as low as 30 microns. More significant, however, is the fact that six-stage ejectors are no longer laboratory devices. Properly designed these will pull down to absolute pressures as low as three or four microns and handle sizable loads in the range of five to ten microns.

* Meet your author on p 193.

Some 30 years ago, metals were first produced in a vacuum furnace. The results were encouraging and somewhat surprising because of the increased quality in the physical properties of the metals. Of course, these initial runs were on a laboratory scale. The transition from laboratory to full-scale production was slow and to some extent uncertain.

Not until recent years have vacuum metals assumed an important position in the metal industry. One of the prime reasons was the inadequacy of equipment to produce and maintain high vacuum.

Until recently manufacturers of vacuum metals relied basically on mechanical pumps. With these pumps, only limited operation is possible because of the large volumes of gases that must be handled.

Let us discuss briefly the techniques that have been responsible for the development of five and six-stage steam-jet air ejectors for operation on an efficient basis.

Uses of Multi-stage Ejectors

Melting of metals under low absolute pressure in electric furnaces produces materials which have

Steam Ejector Principle

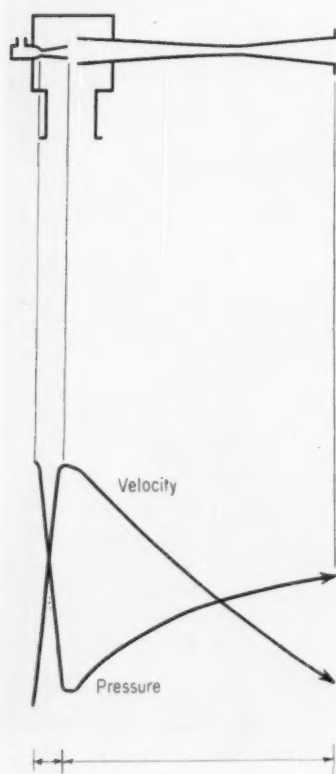


Fig 1

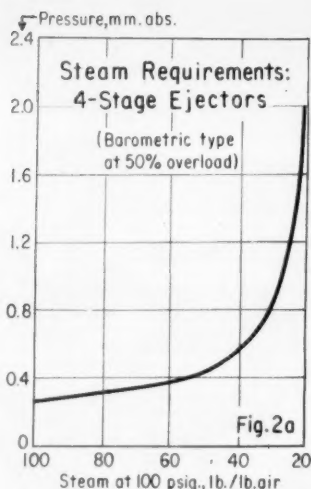


Fig. 2a

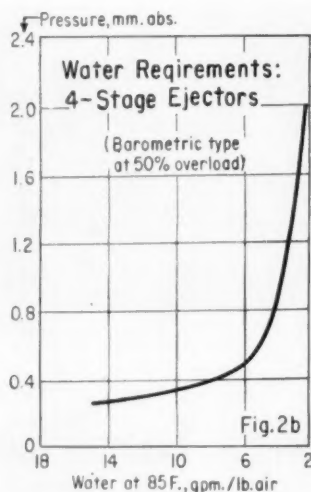


Fig. 2b

Prices of 4-Stage Ejectors, Barometric Type

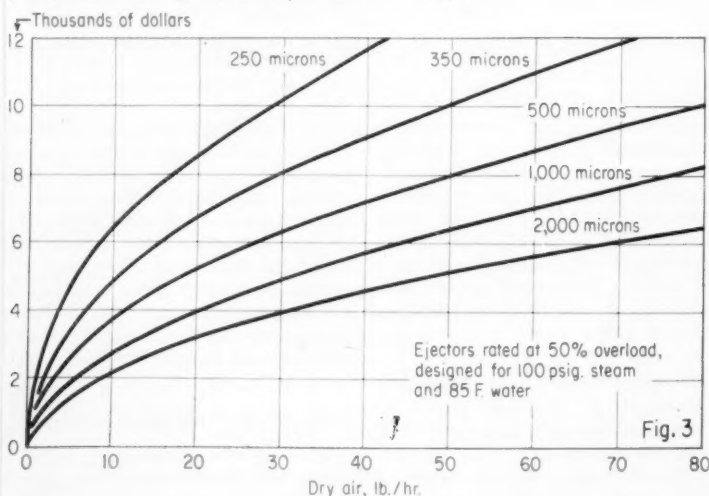


Fig. 3

much greater fatigue life. Also, it vastly improves the impact properties by removing gases that otherwise would be included in the metal.

Industries, particularly those supplying the aircraft field, are constantly searching for metals that provide greater life and safety for their products. Metals processed under high vacuum have been known to increase the life of the alloys of which they are a component by as much as 50%.

Coating of the various metals under high vacuum results in higher quality of coating. High vacuum further offers the advantage of requiring less surface heating as well as insuring an easier and more dependable coating thickness.

Distillation under high vacuum is common for many chemical compounds. One of the main advantages is that distillation of liquids can be accomplished at far lower temperatures than is otherwise possible. This means that some liquids subject to thermal decomposition at high to moderate temperatures can now be safely handled.

Refineries in the petrochemical field are processing materials at absolute pressures as low as 50 to 100 microns with considerably greater yield. At the same time they have been able to derive additional income from new by-products.

Concentration of certain food-stuffs by high vacuum techniques offers the advantage of no foaming and reduces storage and shipping costs.

Freeze drying of important biological products is being used on an ever increasing basis since ordinarily no chemical change nor any bacterial growth takes place during the drying cycle. In addition, oxidation is largely restricted; and since the product is left in a porous state it can be dissolved easily.

Brazing of joints under high vacuum results in an absence of tarnish or discoloration in the heated area and requires no flux removal operations. The efficiency of the joint is considerably higher thus resulting in fewer rejections.

Sintering under vacuum is becoming more popular since the removal of objectionable gases provides for greater strength and longer life.

Annealing of metals under vacuum results in brighter surfaces, thereby saving substantial cleaning or polishing operations.

These are some of the uses for high vacuum equipment. There are dozens of other applications and engineers will find hundreds more in the near future.

Compare Multi-Stage Ejectors

I now present a series of data consisting of utilities and prices and some general data covering steam jet air ejectors.

The production of a vacuum by means of a jet of steam is not a recent invention having been accomplished over 60 years ago.

The principle is simple: steam at a moderate pressure, usually 100 psig., is expanded through a nozzle which converts its pressure energy to velocity. The velocity of the jet of steam entrains air or other gases at some pressure through the suction of the ejector and compresses it to a higher pressure. The principle is shown in Fig. 1.

Steam jet ejectors are designed and built by most manufacturers with one to four stages. Some are equipped with condensers between stages and some are not. These condensers when furnished between stages are called intercondensers. If a condenser follows the last stage, it is then called an aftercondenser. Such condensers may be of the barometric, low-level jet and surface type. The first and last are most commonly used.

Vacuum equipment is now built with up to six-stages. These ejectors can be equipped with any of the aforementioned condensers as required for a given application.

The following pressures are generally considered the minimum practical absolute pressure limits for a given number of stages.

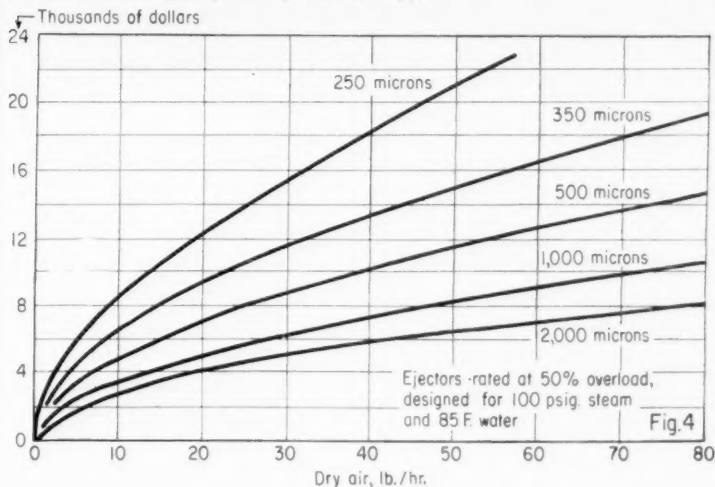
Stages, No.	Absolute Pressure, Mm. Hg
1	50
2	5
3	2
4	0.2
5	0.03
6	0.005

With further experimental work a seven-stage ejector will be made. It is expected to satisfactorily handle loads at absolute pressures at about 0.5 microns (0.0005 mm.).

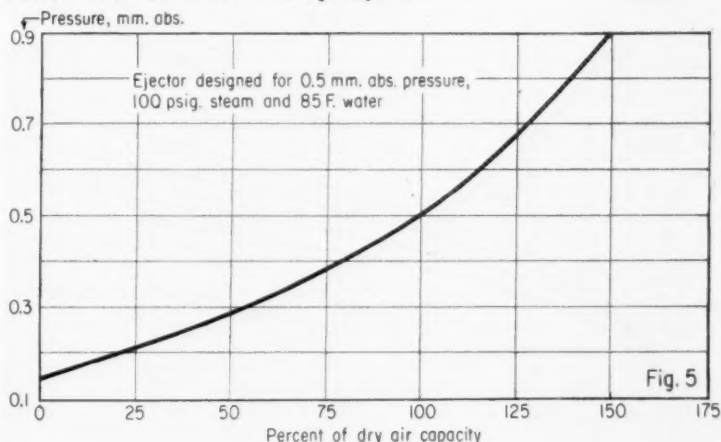
How to Rate Ejectors

The data presented in this article cover only four, five and six-stage

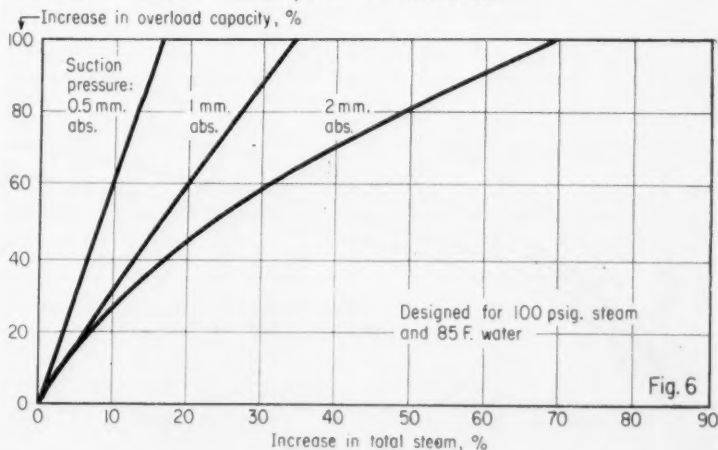
Prices of 4-Stage Ejectors, Surface Type

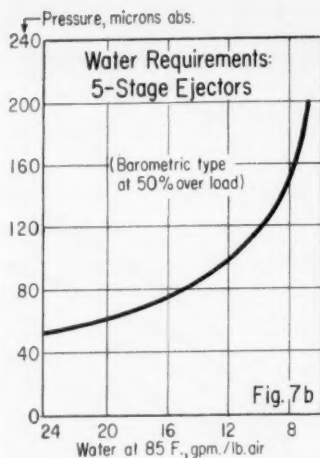
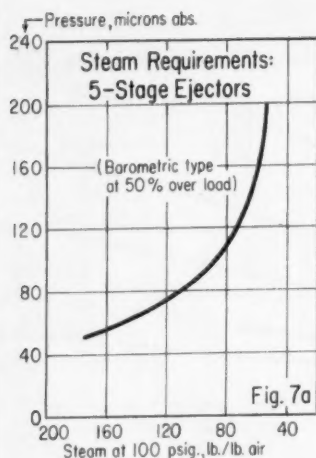


Performance Curve for 4-Stage Ejector

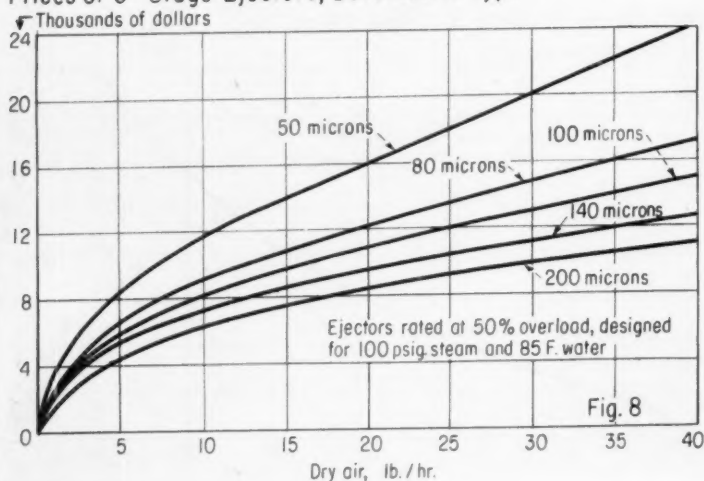


Increase in Steam Consumption for Overloads

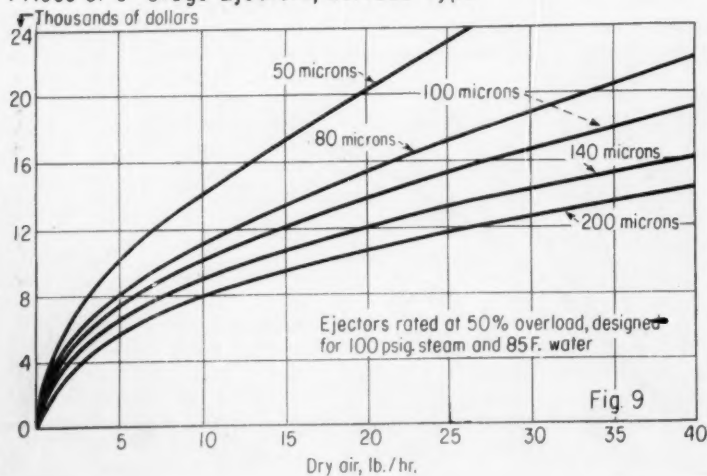




Prices of 5-Stage Ejectors, Barometric Type



Prices of 5-Stage Ejectors, Surface Type



ejectors since a considerable amount of information has been published on ejectors with three or less stages.

Prices and utilities presented here are indicative only. These costs are not intended necessarily to represent those that will apply to a specific problem. Both utilities and prices change radically depending on the size of installation, steam pressure, inlet water temperature and materials of construction.

However, the utilities and prices are sufficiently accurate for general estimating purposes. More complete data are usually available from the equipment manufacturer.

Steam and water requirements are shown in Figs. 2a and 2b for four-stage ejectors in the range from 0.25 to 2 mm. abs. pressure. Note that these utilities apply to ejectors with barometric type intercondensers. This arrangement also applies to five and six-stage ejectors. For any particular pressure, the utilities for units with surface type intercondensers require slightly more steam and water than the unit with the barometric type.

Let us assume our problem is to determine utilities and price for a four-stage ejector to handle 30 lb./hr. free dry air at 0.5 mm. abs. when using steam at 100 psig. and cooling water at 85 F.

From Fig. 2 we find that 43 lb./hr. steam and 5.8 gpm. of water are needed for each pound of air. Therefore, our total utilities are $43 \times 30 = 1,290$ lb./hr. of steam and $5.8 \times 30 = 174$ gpm. of water to handle the load.

In Fig. 3, we find that a four-stage barometric type unit to handle 30 lb./hr. of air costs \$6,300 whereas from Fig. 4, a surface type unit for the same conditions of operation sells for \$8,900.

The use of steam pressure higher than 100 psig. tends to reduce both the steam and water requirements. Inlet water temperatures lower than 85 F. also tend to reduce utilities. Conversely the use of lower steam pressures or higher inlet water temperatures increases steam or water requirements respectively.

The performance of the four-stage ejector we have just selected is shown in Fig. 5. Note that the ejector blanks off (zero load) at 0.15 mm. abs. and carries out to a load of 45 lb./hr. When an ejector is designed in this fashion, it is

said to have a 50% overload capacity.

In most instances, we should insist that the ejector have a reasonable overload capacity. This is particularly true if part of the load to be handled by the ejector is condensable at pressures in the range of 1.5 to 2.25 in. abs. The additional utilities are frequently of no great importance and the ejector cost is rarely increased prohibitively for this overload capacity.

Approximate data are shown in Fig. 6 on the effect of overload capacity on steam consumption for suction pressures in the range of 0.5 mm., 1 mm. and 2 mm. abs. Overload capacity at these and lower absolute pressures causes price to increase to a minor extent—about 10% maximum. It is obvious from these curves that for pressures less than 0.5 mm., the overload feature seldom increases either utilities or price to any appreciable extent.

Utility requirements are given in Figs. 7a and 7b for five-stage ejectors operating in the range from 50 to 200 microns abs. A common range for five-stage ejectors is 100 microns. Therefore, let us select a unit at that pressure to handle 30 lb./hr. of air. From the figure, we find the steam requirement is $86 \times 30 = 2,580$ lb./hr. and cooling water is $11.8 \times 30 = 354$ gpm.

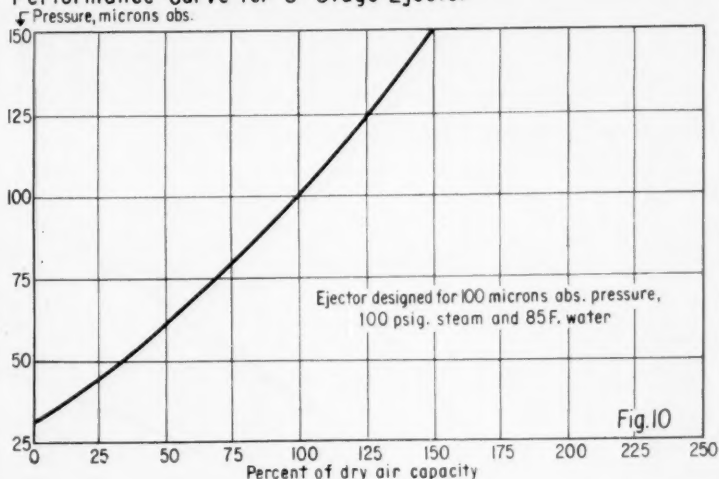
Typical performance is shown in Fig. 10 for a five-stage ejector designed for 100 microns abs. pressure. We find the price for a barometric type unit is \$13,200 from Fig. 8. For the corresponding surface type unit, the price is \$16,600 from Fig. 9.

Five-stage ejectors are rarely used for pressures below 50 microns abs. However, if the steam pressure is high enough and if the cooling water is 70 F. or lower, it is quite possible to design a five-stage unit to operate economically at 30 microns. Under these conditions the ejector blanks off at 15 to 20 microns. However, to provide a more flexible unit, a six-stage ejector is preferred for absolute pressures below 50 microns.

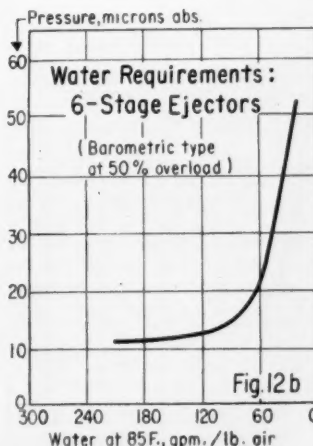
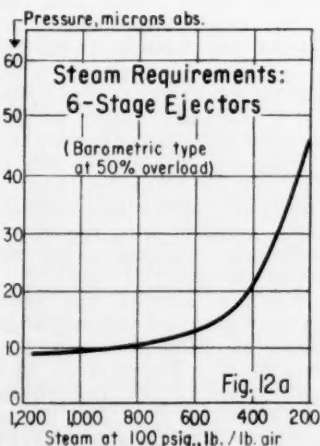
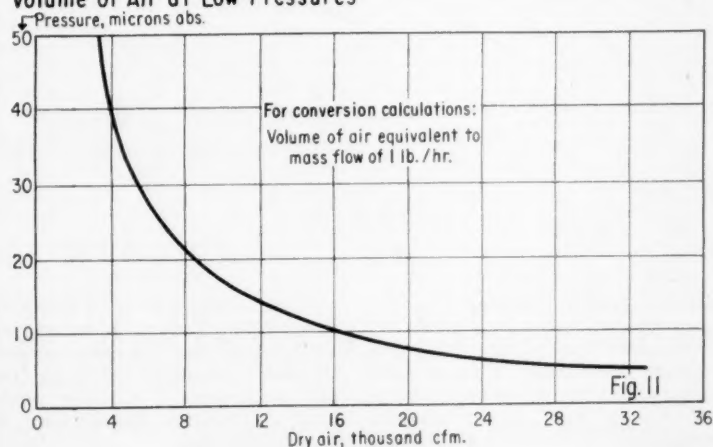
Loads in the low micron range (below 50 microns) are more often than not expressed as volume rate, cfm. instead of mass rate, lb./hr. A comparison is shown in Fig. 11 of capacity expressed in cfm. versus absolute pressure for air flow of 1 lb./hr.

(Continued)

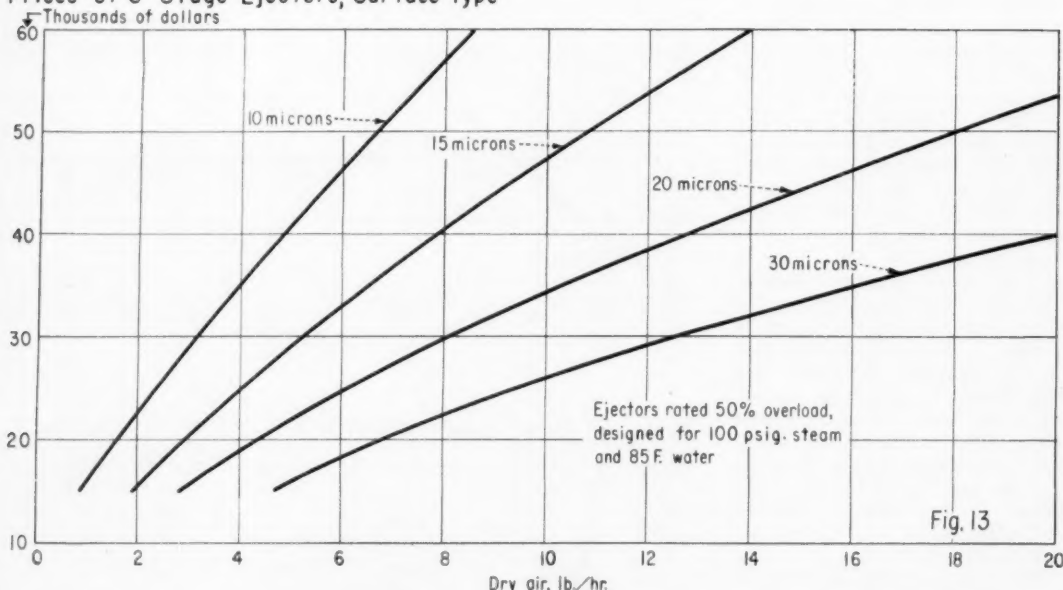
Performance Curve for 5-Stage Ejector



Volume of Air at Low Pressures



Prices of 6-Stage Ejectors, Surface Type



Advantages of Ejectors

Probably one of the most important advantages of steam ejectors is their ability to handle large volumes of gases at low absolute pressures. Ejectors handle these large volumes at relatively low cost when compared to other means of producing the same result.

Let's compare sizes of ejectors

and mechanical pumps. An ejector designed to handle 1 lb./hr. of dry air at 10 microns is a small ejector. However, a mechanical pump for the same removal capacity would have a volumetric displacement of over 16,500 cfm.

A mechanical pump with a displacement of 16,500 cfm. is exceptionally large. In some cases two or more mechanical pumps in parallel are needed because even some of the larger mechanical pumps can not easily handle 16,500 cfm.

As a further example, let us compare the selling prices of an ejector and a mechanical system designed to handle 10 lb./hr. of dry air at 10 microns abs. The ejector sells for about \$75,000. For the same capacity, a three-stage diffusion pump, complete with valving and mechanical roughing pumps sells for approximately \$175,000.

We now examine the selling prices of six-stage ejectors for two capacities. First, we'll consider a capacity of 1 lb./hr. of air at 10 microns abs. Steam requirements are 900 lb./hr. from Fig. 12a and cooling water is 135 gpm. from Fig. 12b. The selling price of \$16,000 for this ejector is found from Fig.

13. Most mechanical systems require several pumps in parallel at a higher price to handle this capacity.

Next, we'll examine a six-stage ejector to handle 2 lb./hr. of air (about 33,000 cfm.). We find from Fig. 13 that it sells for \$22,500. Consequently the comparison shows that the larger the installation the greater the cost advantage is in favor of steam jet ejectors. Typical performance of this six-stage ejector designed to operate at 10 microns abs. is shown in Fig. 14.

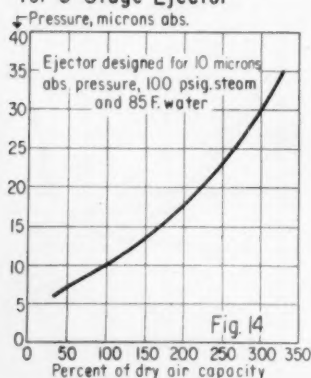
Other Advantages of Ejectors

In addition to the initial cost advantage steam jet ejectors offer:

- Little or no maintenance problems since there are no moving parts.
- Trouble free operation.
- Less space requirements.
- Rapid pump-down time.
- Greater overload capacity resulting in better stability.

It appears that the future of six-stage steam jet ejectors is bright and that seven-stage ejectors for operation in the range from 0.5 to 3 microns abs. are on the horizon.

Performance Curve for 6-Stage Ejector



$$\begin{array}{rcl} \text{Selling Price} & \times & \text{Production} \\ \$2.00/\text{lb.} & & 8,500,000 \text{ lb.} \\ 1,133 & & 1,133 \end{array} = \begin{array}{r} \text{Sales Income} \\ \$17,000,000 \\ 1,133 \end{array}$$

Factor	Cost, Dollars	Significance No.
Raw materials	5,000,000	333
Packages	100,000	7
Oper. labor	600,000	40
Maintenance	1,000,000	67
Power	1,000,000	67
Supplies	50,000	3
Overhead	200,000	14
Depreciation	800,000	52
Technical	500,000	33
Others	250,000	17
Mill cost	9,500,000	633

Sales Income	17,000,000	1,133
- Mill Cost	9,500,000	633
Oper. Earnings	7,500,000	500

Raw materials	500,000	17
Stores	600,000	20
Extra machinery	900,000	30
Semi-finished	800,000	28
Finished prod.	900,000	30
Cash	1,000,000	34
Working capital	4,700,000	159

Perm. Invest.	10,300,000	346
+ Working Capital	4,700,000	159
Total Capital	15,000,000	505

$$\frac{\text{Oper. Earnings}}{\text{Total Capital}} = \frac{7,500,000}{15,000,000} = 50\% \text{ Operating Efficiency}$$

FOR A MORE PROFITABLE OPERATION . . .

Rate Economic Factors by Importance

Cost alone doesn't always determine the significance of the economic factors that make up a process. Here's a new technique to find the relative importance of these factors.

KENNETH FINLAYSON, Pigments Dept., E. I. du Pont de Nemours & Co., Edge Moor, Del.*

With manufacturing costs steadily on the rise and markets becoming more competitive, many companies now find themselves in the middle of a cost-price squeeze.

Most managements are facing this dilemma by increasing capital expenditures so as to expand their capacity. In this attack lies a hope that volume can be increased fast enough to keep the spread between operating costs and selling price from getting out of line.

Managements of the larger organizations are also hitting at overhead costs as a means of keeping this cost-price spread from widening.

*Meet your author on page 190.

Electronic computers have been applied to such areas as stores inventory accounting, payrolls, raw materials control and linear programming. However, modest-size operations find it difficult to justify the use of computers. Their larger competitors, therefore, have a substantial advantage over them in their fight against the cost-price squeeze.

An investigation of the type of analysis used for computer justification reveals that certain disciplines can be applied to supervisory control. Without going so far as to install complicated and expensive computer programs, these disci-

plines provide a simple and powerful tool for supervision of the economic factors affecting the success of a business.

Thus, the computer analysis type of thinking can be used to keep a step ahead in the competitive fight. It also has the collateral advantage of gradually incorporating an organized method of economic thinking. This will serve to pave the way for the coming "age of computers."

What Is Significance?

Each of us is frequently faced with the problem of choosing be-

tween alternative courses of action in trying to reach our goals.

When several possibilities exist, each one of which may contribute toward the desired end, we automatically rate each alternative. We'll select the one that will contribute most significantly to attaining our aims. Where several courses of action can be undertaken simultaneously, our judgment tells us to deploy our energies. How significantly each course of action will affect the end result determines the proportion of energy expended.

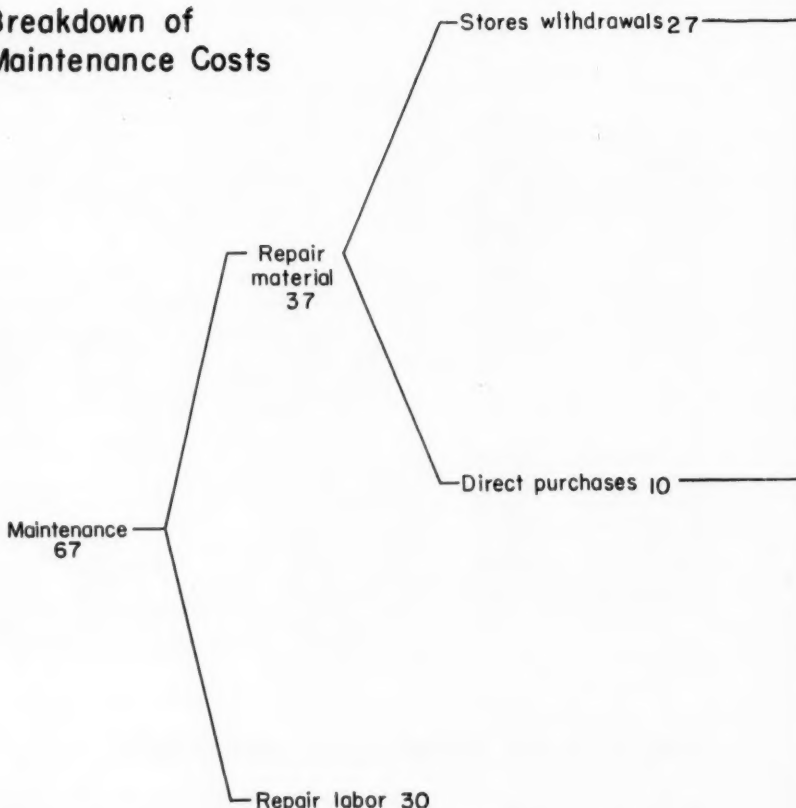
In the ordinary course of human endeavor such judgment involves the evaluation of intangibles. On the other hand, in the supervisory control of the economics of a business, each factor can be given a dollar value and its significance is subject to calculation.

It can't be assumed that all economic factors affect the success of a business in proportion to their dollar values. Dollars tied up in capital accounts, for example, exert an effect different from dollars spent for labor and materials.

Before evaluating economic factors it's first necessary to select a goal that will be a measure of the success of any business.

Operating efficiency, defined as the ratio of operating profits to total capital, includes all those economic factors under control of operating supervision. Relationship of the factors making up this ratio is shown in the introductory figure. By analyzing these factors using the disciplines developed for studying computer applications, a powerful but simple tool emerges to help

Breakdown of Maintenance Costs



Here's the Relative Significance

Selling Price	1,133
Production	1,133
Permanent investment	346
Raw materials cost	333
Maintenance cost	67
Power costs	67
Depreciation	52
Operating labor cost	40
Cash	34
Technical expenses	33
Extra machinery	30
Finished product inventory	30
Semi-finished inventory	28
Stores investment	20
Other operating costs	17
Raw material inventory	17
Overhead costs	14
Packaging costs	7
Supplies cost	3

supervision improve their control of operations.

Operating efficiency is the ratio of two kinds of money: money in motion and money standing still. Operating profits, sales income and mill costs all represent money on the move—either money being spent at a definite rate or money coming in at so much a day, week, month or year.

Capital, on the other hand, represents money immobilized in the cost of manufacturing facilities or invested in working capital items. To improve operating efficiency, the problem facing supervision is to control each factor in relation to its significance. Factors included in mill costs, which represent a flow of money, must be related to items of investment or working capital.

This relationship can be calculated by defining the significance of any item as the change in operating efficiency accompanying a change in the value of the item. For the purpose of operating control,

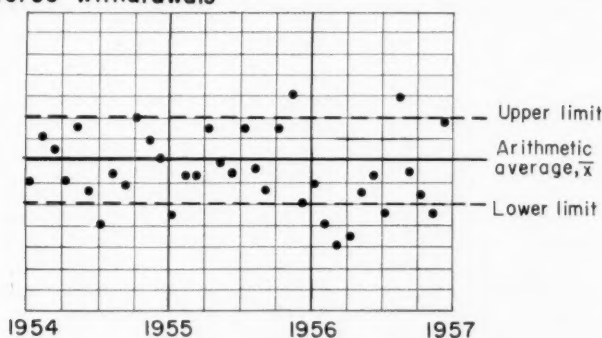
the involved mathematics required to relate the many dependent variables can be safely bypassed. Significance can be calculated directly and simply by showing how much operating efficiency would improve with a 1% improvement in each item.

For example, in the accompanying illustration, operating efficiency is shown as 50%; the ratio of operating earnings of \$7.5 million to total capital of \$15 million. A \$1-million expense item, such as maintenance, would have a significance of 0.067%; 1% of \$1 million divided by \$15 million.

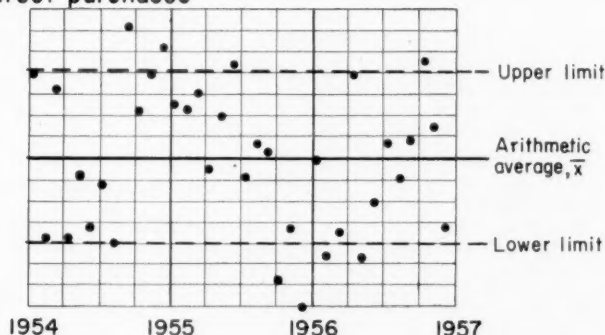
Thus by reducing maintenance costs by 1%, mill costs would be reduced by \$10,000. Operating earnings would climb a like amount to \$7,510,000 and the operating efficiency would become 50.067%.

If the percentage increase in efficiency with a 1% improvement in an item is multiplied by 1,000, or any other convenient factor, a significance number will result. This

Stores withdrawals



Direct purchases



number for the \$1 million maintenance item (throughout this article we'll make use of a factor of 1,000) becomes 67.

Advantages that can be attributed to the use of such a number are as follows:

- Economic factors can be listed in order of their relative significance.
- Insignificant items can be eliminated.
- Supervisory efforts can be more intelligently directed.
- Information that might otherwise be confidential can be widely disseminated.
- Individual items can be more intelligently selected for analysis of improvement potential.
- A way is opened for data processing for improved management control of operations.

Now for Relative Significance

In the same figure, economic factors are shown with dollars as well

as with significance numbers. Significance of capital accounts is calculated in the same manner as items of expenditure.

However, the significance of a \$1 million item of expenditure is different from a \$1 million capital account. Where the significance number of the expenditure would be 67, that of the investment item would be 33. Thus with a 50% operating efficiency, costs items are twice as significant as the items that make up investment.

Of course, the figures we've used have been arbitrarily selected for illustrative purposes and bear no relation to an actual business. But once actual figures are plugged into an efficiency chart, the true relationship of expenditure and capital items will become apparent at a glance.

When significance numbers have been assigned to all major categories, it's interesting to list them in the order of their relative significance. Such a list reveals re-

lationships not formerly obvious. Capital items fall into place in relation to cost items. The relative importance of production is clarified and it becomes apparent that some items are relatively insignificant.

It now becomes clear that assigning significance numbers to the factors affecting operating efficiency gives an overall picture of an operation not otherwise apparent. Where supervisory efforts may have been of the expedient type, hysterically engaged in putting out fires as fast as they spring up, they can now be replaced with an integrated plan. A clear picture of the whole economic structure with efforts directed in relation to the relative significance of the component items can be achieved.

It should be pointed out that significance rating, in itself, does nothing to replace supervisory judgment. It merely provides a clear picture to help direct supervisory efforts.

In directing these efforts, the use of significance numbers permits the immediate elimination of relatively insignificant items. One of the most rewarding and immediate benefits of listing all items in the order of their significance is to find that some cherished number, the control of which has been absorbing a great deal of supervisory effort, turns out to be relatively insignificant when compared to some long ignored item.

Uses of Significance Numbers

There is an immediate advantage in the use of significance numbers in that lower levels of supervision can participate in a cost control program.

Figures that otherwise would be too confidential for general dissemination when reduced to significance numbers can be given general distribution. In this way all supervisory personnel can see where their efforts should be directed. Where capital items such as in-process inventory or extra machinery were formerly of nebulous significance, their relationship to cost items can be made clear to the man in the field. In the final analysis, this man is the one whose activities must be directed if the items are to be controlled.

As experience is gained with significance numbers, many uses pe-

culiar to individual operations will develop. For example, where an insurance item is to be added to extra machinery you can easily calculate how much production loss will justify the extra investment.

Significance rating encourages thinking in terms of operation efficiency rather than in terms of cost alone. It can often be shown that purposely increasing a particular cost can produce overall benefits that will improve operating efficiency. Overtime for maintenance may be very low in one operation and high in another. It might be that a transfer of personnel would bring the overtime into balance. Thus increasing overtime costs in one department would result in an overall cost reduction where in another department the opposite would be true.

It soon becomes apparent that the intelligent use of significance numbers requires still another discipline; that of analyzing items for improvement potential.

Look for Improvement Potential

Items of high significance may have a limited potential for improvement, whereas items of lower significance may have a great potential. In many instances this potential may be obvious to those in intimate contact with the operation. However, it's often useful to break down an item into its components and calculate a standard deviation, based on historical data for each component.

Using maintenance cost again as an illustration, a breakdown into repair labor and repair materials can be made. Further breakdown of materials can be made into stores withdrawals and direct purchases. Using historical data, a standard deviation can be calculated for each by means of the following equation (see *Chem. Eng.*, March 1956, pp. 165-190, or any standard reference on statistical analysis):

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (\bar{x} - x_i)^2}{n}}$$

where x_i is any individual term, \bar{x} is the arithmetic average and n is the number of terms.

This equation gives one-sigma limits (σ), sometimes known as the root mean square deviation, and shows the dispersion of the data. It's not intended to go into the de-

tails of statistical analysis other than to suggest that the spread of the one-sigma limits is a clue to the improvement potential.

One-sigma limits for stores withdrawals and direct purchases is shown. It's interesting to note that stores withdrawals has very narrow limits and direct purchases much wider ones.

Familiarity with stores control suggests that limits on stores inventories and adherence to fixed maximum and minimum limits for each store item are limiting factors which keep withdrawals within relatively narrow limits. Direct purchases on the other hand have no such arbitrary restrictions with the result that much wider fluctuations are experienced.

Thus by breaking items down into their components and comparing their standard deviations, it becomes apparent where additional efforts would be rewarding.

All this points out the need for a better understanding of the processes that make up your operation. Basic causes of fluctuations are the key to this understanding. Some operations can easily be seen to need better control, while others are working at their minimum practical limits.

From this better understanding we should be able to set control limits on an operation like direct purchases where they'll be the most efficient and economical.

It should be borne in mind that statistical analysis is merely a way of analyzing data. Care should be taken not to draw any far-reaching conclusions not inherent in the method. It can be stated, however, that experience using standard deviations as a guide for directing supervisory efforts has been uniformly successful in making substantial improvements in operating efficiency.

The Road Ahead

Significance rating and analysis for improvement potential, valuable as they are in giving immediate aid in improving operating efficiency, are actually only the first steps. The road leads toward the use of data-processing for improved management control of operations.

Peering into the future, the development of management by exception can be seen. All this great welter of operating data now ex-

amined daily by supervision will be screened automatically and only those items requiring a decision will be reported.

Supervision will be relieved of the chore of examining large volumes of unrelated data most of which turns out to be under control. All such data can be predigested relative to operating efficiency. Only that portion requiring action will be abstracted and reported to the person who exercises control and reported at the frequency that control is needed.

It can be envisioned that the goal of supervisory control will be daily, weekly or monthly reports that will be blank pieces of paper. A measure of control will not be how much is shown in reports but how few items needing attention will appear. Thus an integrated data-processing system won't only result in automatic accounting but will result in a great strengthening of supervisory control.

The Next Step

A detailed description of the next step, which is the analysis of source data, is beyond the scope of this article. Here again, substantial benefits can be expected whether or not an integrated data-processing program is adopted. This technique involves tracking down every datum to its source, developing flow charts to integrate all the data, analyzing what it's to be used for and who uses it. Benefits from such an analysis result from uncovering duplications and weeding out futile operations.

This discipline again is a step toward automatic data-processing as it's the source data that's organized for automatic processing.

It's hoped that the foregoing discussion will help dispel the idea that because automatic data-processing equipment is expensive no further consideration should be given to data-processing.

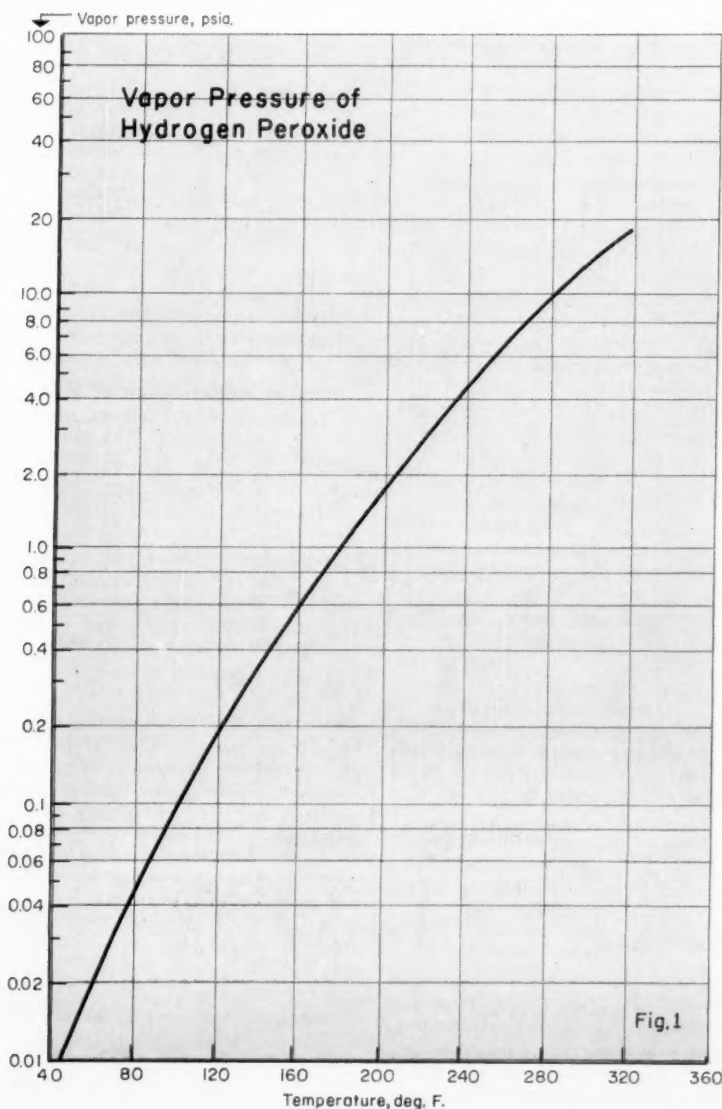
Procedures and methods of analysis used for computer programming can be applied to give supervision new and powerful controls. As they're developed, it's hoped these controls will show that there are large improvements possible in operating efficiency. Improvements that well may be sufficient to justify application of automatic equipment for a completely integrated control system.

Rocket

Missile Era

Accentuates Importance of . . .

Heat Content and V.P. of H_2O_2



D. J. SIMKIN and C. O. HURD
Shell Dev. Co., Emeryville, Calif.

In recent years, promising new uses¹ for an old but exciting chemical have attracted our attention. Hydrogen peroxide, its oxidizing properties long known to chemical engineers, is now emerging into an era of rockets and missiles as a glamorous and powerful fuel oxidant.

All of the new uses for hydrogen peroxide require an extensive knowledge of physical and thermodynamic properties in the pure state. Vapor pressure and heat content data presented here are calculated from equations extensively derived in an earlier paper (*Jet Propulsion*, April 1957, pp. 419-420). These equations give data that are both accurate and thermodynamically sound representations of the physical properties.

Vapor Pressure

An equation for the vapor pressure of hydrogen peroxide was derived from the heat of vaporization by means of the Clapeyron equation. This equation:

$$\log P_{\text{psia}} = 24.217716 - 6.075.2/T - 5.23700 \log T$$

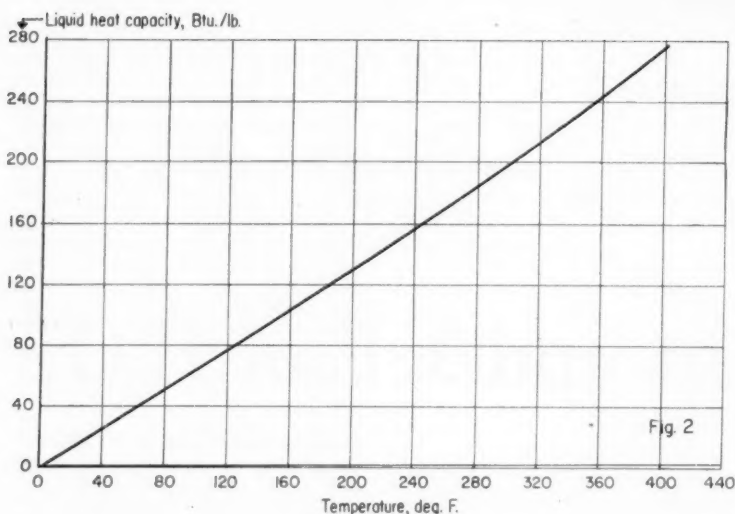
where T is given in degrees Rankine, is shown graphically in Fig. 1.

By utilizing a vapor pressure equation which makes use of the heats of vaporization directly instead of correlating vapor pressure data alone, thermodynamic consistency is achieved.

In addition, with a polar substance such as hydrogen peroxide, deviations from ideality are taken

¹Meet your authors on page 192.
Mr. Simkin is now with Marquardt Aircraft Co., Van Nuys, Calif.

H₂O₂ PROPERTIES . . .

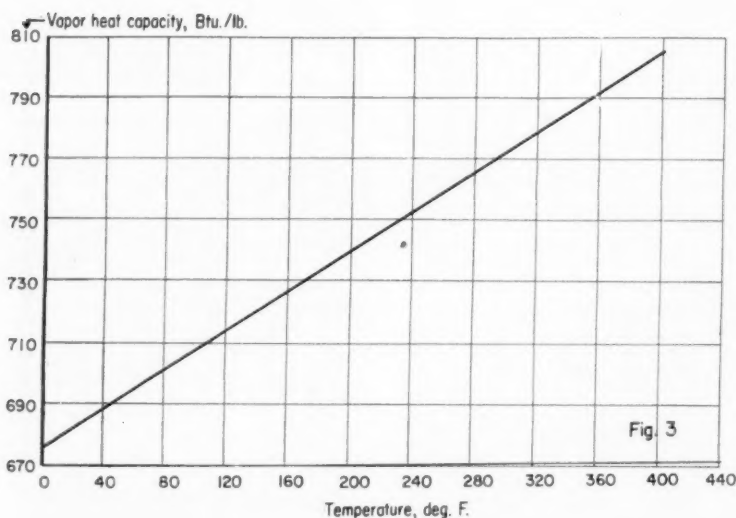


Heat Content of H₂O₂ Liquid

Temp., Deg. F.	$h_{sat.}$, Btu./lb.
0	0
40	24.84
80	49.98
120	75.58
160	101.39
200	128.06
240	155.46
280	183.62
320	212.52
360	242.52
400	274.11

Heat Content of H₂O₂ Vapor

Temp., Deg. F.	$H_{sat.}$, Btu./lb.
0	676.12
40	688.70
80	701.49
120	714.55
160	727.54
200	740.71
240	753.88
280	767.02
320	779.96
360	792.54
400	804.56



Heat of Vaporization of H₂O₂

Temp., Deg. F.	H_v , Btu./Mole
0	22,999
40	22,582
80	22,162
120	21,735
160	21,299
200	20,840
240	20,346
280	19,845
320	19,302
360	18,713
400	18,044

into account by assuming both the gas and liquid P - V - T properties are described by the equation:

$$PV = ZRT$$

A comparison of some experi-

mental vapor pressure data^{2,3} with those of the equation shows the calculated values to be within the error of the experimental data.

Temp.	Vapor Pressure, mm.	
	Calc.	Exper.
60 C.	17.90	17.7
90 C.	78.29	78.4

Nomenclature

$H_{sat.}$	Heat content, saturated vapor
$h_{sat.}$	Heat content, saturated liquid
ΔH_v	Heat of vaporization
P	Vapor pressure
R	Gas constant
T	Temperature
Z	Gas or liquid compressibility factor in the equation $PV = ZRT$

Heat Content

By determining the latent heat of vaporization from the equation and making certain other basic assumptions a heat content table was constructed and is shown in Figs. 2 and 3. Liquid heat capacities calcu-

lated from the slope of the saturated heat content curve of Fig. 2 show excellent agreement with experimentally measured values.^{4,5}

REFERENCES

1. "Rocketing Peroxide Output," *Chem. Week*, March 3, 1956, p. 72.
2. Scatchard, C. S., G. M. Kavanagh and L. B. Ticknor, "Vapor-Liquid Equilibrium, VIII—Hydrogen Peroxide-Water Mixtures," *J. Am. Chem. Soc.*, **74**, 3715 (1952).
3. Schumb, W. C., C. N. Satterfield and R. L. Wentworth, "Hydrogen Peroxide," Reinhold Publ. Co., New York, 1955.
4. Foley, W. T., and P. A. Giguere, "Hydrogen Peroxide and Its Analogues," *Can. J. Chem.*, **29**, 895 (1951).
5. Giguere, P. A., I. D. Liu, J. S. Dugdale and J. A. Morrison, "Hydrogen Peroxide: The Low Temperature Heat Capacity of the Solid and the Third Law Entropy," *Can. J. Chem.*, **32**, 117 (1954).

Calculate Adequate Rupture Disk Size

Explosions from combustible mixtures can be safely vented if rate of pressure increase is taken into account when disks are selected.

J. G. LOWENSTEIN, Food Machinery and Chemical Corp., Baltimore, Md.*

Up until now we haven't had any sure way to calculate disk sizes to protect valuable equipment against unforeseen explosions.

It's a simple matter to figure the necessary vent capacity if the overpressure results merely from an increase in the volume of a liquid or gas.

If a chemical reaction causes the overpressure, disk design becomes more difficult. A knowledge of the kinetics of the particular reaction is necessary.

But when an explosion causes the overpressure, the designer usually guesses at a disk size. And he feels that the explosion will probably wreck the vessel regardless of its protection.

Protection is possible. The data we present here show how.

The chart on the next page is constructed according to the method of Lalanne using the equation:

$$\log p + \log v - \log c = 0$$

This is equivalent to $p \times v = c$.

Chart data represent explosions of vapors and gases in an air mixture at an initial temperature of 150 F. and 1 atm. The chart shows only the worst hazard or the optimum explosive mixture.

On the vertical axis is the average rate of pressure rise, psi./sec.; on the horizontal axis is the time to attain maximum pressure, sec. and the diagonal axis gives the maximum pressure reached in the explosion, psi.

Thus we can read from the graph the maximum pressure reached during a vapor-air explosion, time required to reach maximum pressure and rate of pressure rise.

It is interesting to note that all the points lie around the 100 psi. maximum pressure line. Only a very few such as acetylene, acrylonitrile and ethylene exceed 100 psi. None of the gases shown exceeds 150 psi.

Hence a pressure vessel rated for 150 to 200 psi. will in all probability withstand a vapor or gas explosion

without rupturing. This is especially true of vessels with welded rather than bolted heads. Experience has actually shown that such vessels can easily take even a hydrogen-air burp.

In any case, emergency vents should be installed. However, the possibility of an explosion in a vessel will necessitate extra-large vents to permit the rapid removal of the reaction products before a dangerous build-up in pressure is attained.

Again referring to the graph, we see that the time spread (0.01 to 0.5 sec.) for the listed vapors and gases amounts to a factor of fifty. Note that the average time to attain maximum pressure is approximately 0.06 sec. and that 17 of the 24 compounds are near this time.

Let us use an illustrative example to show that protection is possible for even a rapid pressure build-up.

Problem—What size rupture disk is necessary to protect a 100 gal. pressure vessel, rated for 100 psi., from damage caused by an ethylene-air explosion?

These data are available:

Volume of vessel, 13.3 cu. ft.

Code pressure, 115 psia.

Temperature inside vessel, 150 F.

Ethylene in vessel, 8% by volume.

Maximum possible pressure caused by explosion, 120 psi. (from graph).

Rate of pressure build-up, 6,600 psi./sec. (from graph).

Time to attain maximum pressure, 0.018 sec. (from graph).

Nomenclature

<i>a</i>	Effective orifice area, sq. in.
<i>C</i>	Orifice coefficient = 0.81 for vapors and gases.
<i>M</i>	Molecular weight
<i>P</i>	Pressure, psia.
<i>p</i>	Pressure, psia.
<i>R</i>	Gas constant = 1,545.3 ft.-lb./mole-deg. Rankine
<i>T</i>	Temperature, deg. Rankine
<i>V</i>	Volume, cu. ft.
<i>W'</i>	Weight of vapors, moles.
<i>W</i>	Discharge through orifice, lb./hr.

Solution—First we'll calculate the amount of vapor in vessel, assuming that all components behave like ideal gases. Pressure is assumed 115 psia. since this is the pressure inside the vessel just prior to the bursting of the rupture disk.

$$W' = PV/RT$$

$$= \frac{115 \text{ psia.} \times 144 \text{ sq.in./sq.ft.} \times 13.3 \text{ cu.ft.}}{1,545.3 \text{ ft.-lb./mole-deg.R.} \times 610 \text{ R.}}$$

$$= 0.234 \text{ moles of vapor.}$$

Equivalent molecular weight of the vapor is 0.08×28 (molecular weight of ethylene) + 0.92×29 (molecular weight of air) = 28.9 lb./mole.

The amount of vapor to be vented is therefore $0.234 \times 28.9 \times 3,600/0.018$ which equals 1,350,000 lb./hr. The weight of the products of combustion must equal the weight of the original components. No increase in temperature is assumed.

The most useful capacity formula here is the one suggested in the API-ASME Joint Code for the discharge of mixed vapors.

$$W = 306 \text{ Cap } (M/T)^{0.5}$$

Solving for *a*, we get

$$a = \frac{1,350,000}{306 \times 0.81 \times 115 \times (28.9/610)^{0.5}}$$

An area of 217 sq. in. has a diameter of 16.7 in., therefore needs a 17-in. rupture disk. If the vessel has no 17-in. nozzle, a number of smaller rupture diaphragms may be used. Of course their total area must equal at least 217 sq. in.

This answer agrees closely with the result obtained by using the nomograph published by T. S. Murphy, Jr., *Chem. Eng.*, Dec. 1944, p. 103.

Here we find that a rather large emergency vent area is necessary. Note also that the vessel can be vented even though the pressure buildup is relatively rapid. Rupture disk size may thus be calculated for any vessel.

Finally, here are the effects of temperature on the explosion data. As the initial temperature increases:

* Meet your author on p. 194.

• Maximum pressure developed decreases.

• Time to attain maximum pressure decreases except for hydrogen where time increases.

• Average rate of pressure rise increases except for benzene and hydrogen where rate decreases.

REFERENCES

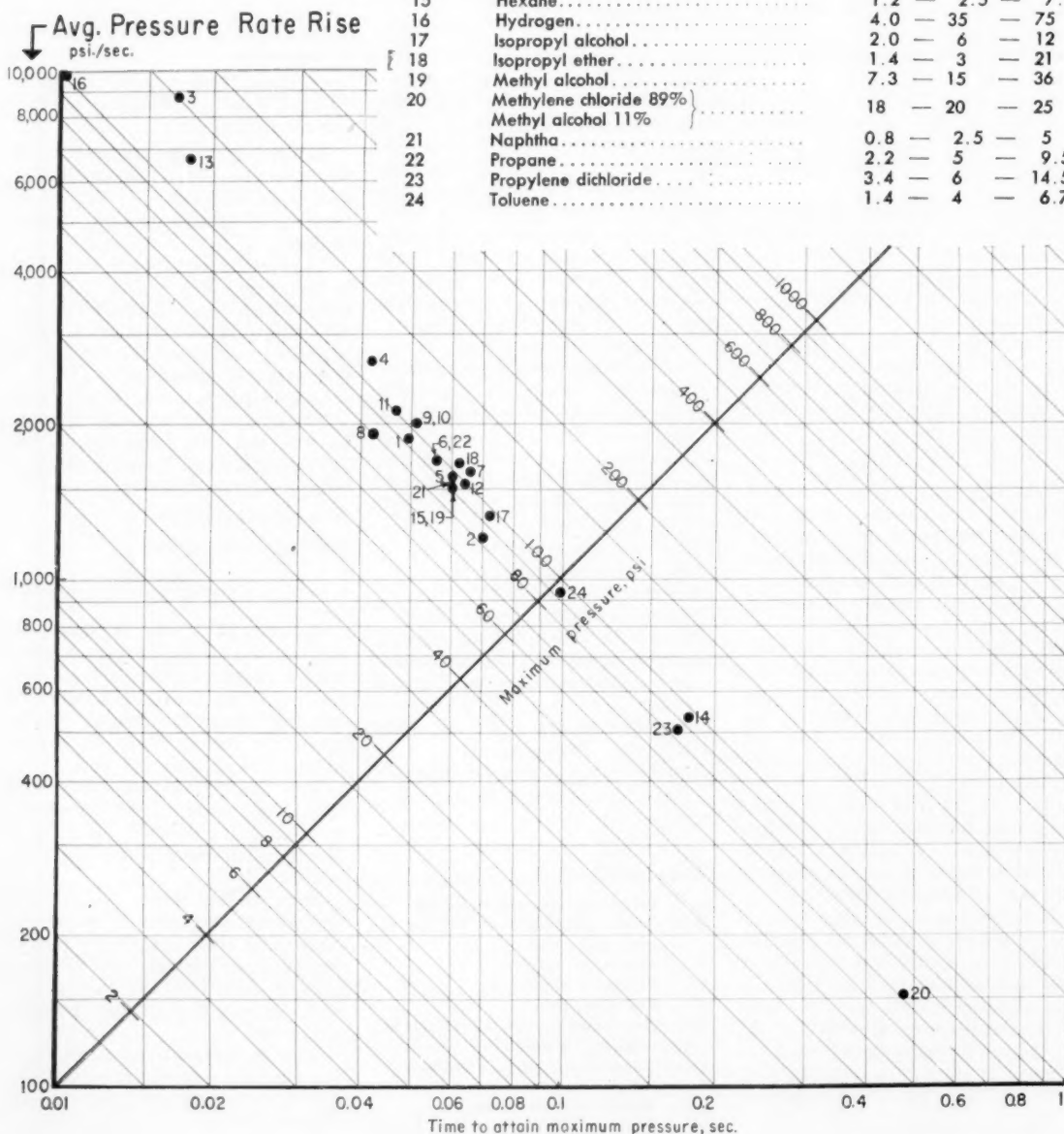
1. "Guide for Explosion Venting," NFPA No. 68, National Fire Protection Assn., Boston (1954).
2. Coward, H. F. and G. W. Jones, "Limits of Flammability of Gases and Vapors," Bull. 503, Bureau of Mines, Washington (1952).

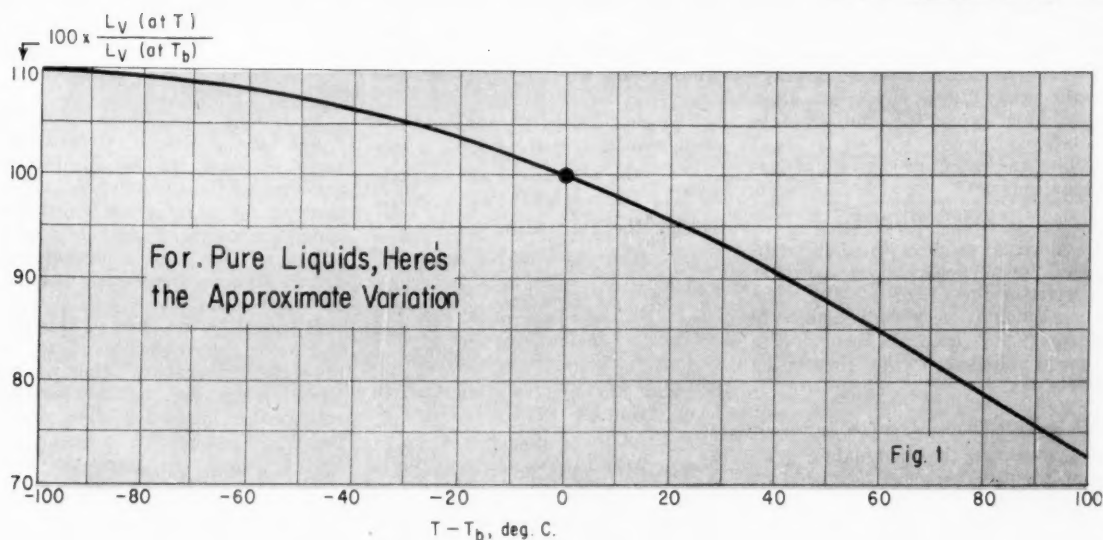
Explosive Mixtures (% by Volume in Air)

Chart
Key No.

These Are Limits²
This Is Optimum¹

Chart Key No.	Explosive Mixture	Lower Limit (%)	Optimum (%)	Upper Limit (%)
1	Acetaldehyde	4.1	11	55
2	Acetone	3.0	6	11
3	Acetylene	2.5	13	81
4	Acrylonitrile	3.0	8	17
5	Benzene	1.4	4	7.1
6	Butane	1.9	5	8.5
7	Butyl alcohol	1.4	6	11.2
8	Butyrolactone	3	8	12
9	Cyclohexane	1.3	3	8
10	Diethyl ether	1.9	5	48
11	Ethane	3.0	7	12.5
12	Ethyl alcohol	4.3	12	19
13	Ethylene	3.1	8	32
14	Ethylene dichloride	6.2	10	16
15	Hexane	1.2	2.5	7.5
16	Hydrogen	4.0	35	75
17	Isopropyl alcohol	2.0	6	12
18	Isopropyl ether	1.4	3	21
19	Methyl alcohol	7.3	15	36
20	Methylene chloride 89%	18	20	25
21	Methyl alcohol 11%	0.8	2.5	5
22	Naphtha	2.2	5	9.5
23	Propane	3.4	6	14.5
24	Propylene dichloride	1.4	4	6.7
25	Toluene	1.4	4	6.7





Temperature vs. Heat of Vaporization

Latent heat of phase change—either in the form of latent heat of vaporization, fusion or sublimation—will pop up in your engineering calculations. Use these reliable methods to stretch out meager data.

WALLACE R. GAMBILL, Union Carbide Chemicals Co., Charleston, W. Va.*

Often you have available a single value of the latent heat of vaporization at a given temperature—most often at the normal boiling point—but need a value at a different temperature. A number of excellent methods are available for this.

As we mentioned earlier in this series, over a moderate temperature range of less than about 100 deg. C., latent heat is practically a linear function of temperature.

$$L_T = A - BT$$

with good accuracy. Latent heat of vaporization falls with rising temperature, becoming zero at the critical point.

Use These General Methods

For larger temperature differences, we can rely on several gen-

eralized correlations. We have chosen several methods for discussion.

Method 1—"Theisen's Correlation"

We discussed this method in some detail in our last issue (*Chem. Eng.*, Dec. 1957, p. 261) and included a nomograph that quickly solves the correlation equation:

$$\frac{L_{T_2}}{L_{T_1}} = \left(\frac{1 - T_{r2}}{1 - T_{r1}} \right)^{0.38}$$

Accuracy is quite satisfactory over the entire range of available data, including the immediate vicinity of the critical point. The average deviation for all types of compounds is about plus or minus 4%.

Method 2—Boiling-Point Change

Knowing that the boiling point, T_b , can be approximately related to critical temperature, T_c (many relations have been proposed; Guld-

berg's $T_b/T_c = 2/3$ is the simplest), one would expect that some sort of correlation would come out of plotting $(T - T_b)$, which we shall call the boiling-point displacement, vs. change of latent heat of vaporization from its value at the boiling point.

This correlation was first noted in a Union Carbide Chemicals Co. data book (Acetone, 1944) and has since been further generalized by including data for compounds of several types.

We have shown this correlation in the figure above. It is based on data for eight compounds—seven organics, including two polar alcohols, and one inorganic. The ordinate gives the latent heat at temperature T as a percentage of that at the normal boiling point, T_b . The listings below indicate the accuracy of the correlation.

For the region of the curve where T is less than T_b , we used 15 points

*Mr. Gambill is now with the Union Carbide Nuclear Co., Oak Ridge, Tenn. To meet your author see *Chem. Eng.*, Feb. 1957, p. 324; and Aug. 1957, p. 329.

with a 1.6% average error and 1.6% maximum error. In the region where T is greater than T_s , we had 28 points with 1.6% avg. error and 8.1% max. error. Over-all average error was 1.25%, with an 8.1% maximum error for the 43 data points.

The indicated errors above are deviations of

$$(L_v \text{ at } T)/(L_v \text{ at } T_s)$$

as an actual value vs. the value indicated by the correlation curve at a given value of $(T - T_s)$. The correlation is very convenient and surprisingly accurate considering the simplicity of the correlation variables.

Method 3—Thermodynamic Approach

The exact thermodynamic relation for the change of L_v with temperature is:

$$(dL_v/dT) = (L_v/T) + C_{Pv} - C_{Pl} - (TdP/dT) \frac{d(V_v - V_l)}{dT} \quad (1)$$

where the subscript v denotes vapor and the subscript l denotes liquid; and where dP/dT is total, i.e., along the saturation curve where P changes with T .

If we assume that the vapor obeys the ideal-gas laws and that liquid volume can be neglected in comparison with vapor volume, then

$$V_v = RT/P$$

and

$$dV_v/dT = R/P$$

By proper substitution in Eq. (1) and in conjunction with the appropriate form of the Clapeyron equation, we arrive at:

$$dL_v/dT = C_{Pv} - C_{Pl} = \Delta C_P \quad (2)$$

with all quantities on a molar basis.

Within the bounds of the two assumptions involved, the relation is satisfactory. It may also be derived from:

$$(\partial L_v / \partial T)_P = \Delta C_P \quad (3)$$

if the constant-pressure restriction is removed and the effect of changing pressure along the saturation curve is neglected. It's clear that Eq. (2) should be used only at low or moderate pressures.

Consequently, if good C_P data are available, we can calculate a latent heat from a known value by:

$$L_{v2} = L_{v1} - (C_{Pl} - C_{Pv})(T_2 - T_1) \quad (4)$$

where T_2 is greater than T_1 and the C_P values are taken at the average

temperature. Well below the critical point, this relation is very satisfactory for $(T_2 - T_1)$ less than or equal to 25 deg. C. and is fairly accurate up to $(T_2 - T_1) = 100$ deg. C.

The heat capacity equations are often available in the form:

$$\begin{aligned} C_{Pv} &= a + bT + cT^2 \\ C_{Pl} &= a + bT + cT^2 \end{aligned} \quad (5)$$

Taking the difference:

$$\Delta C_P = \Delta a + \Delta bT + \Delta cT^2 \quad (6)$$

where,

$$\begin{aligned} \Delta a &= a_v - a_l \\ \Delta b &= b_v - b_l \\ \Delta c &= c_v - c_l \end{aligned}$$

So that at any two temperature levels, from Eq. (2):

$$\begin{aligned} (L_v)_{T_2} &= (L_v)_{T_1} + \Delta a(T_2 - T_1) + \\ &\quad 0.5 \Delta b (T_2^2 - T_1^2) + \\ &\quad 0.33 \Delta c (T_2^3 - T_1^3) \end{aligned} \quad (7)$$

allowing the calculation of L_v at any temperature—within the low-pressure range—from a knowledge of L_v at one temperature and the temperature dependencies of C_{Pv} and C_{Pl} .

Note that dL_v/dT is obtainable from the Theisen function (Method 1, above) by differentiation. So that if

$$L_v = k(T_c - T)^n$$

then,

$$\frac{dL_v}{dT} = - \frac{kn}{(T_c - T)^{1-n}} \quad (8)$$

Previously, we have indicated that a recommended value of $n = 0.38$ is useful for engineering calculations. Therefore,

$$\frac{dL_v}{dT} = - \frac{0.38k}{(T_c - T)^{0.62}} \quad (9)$$

The constant, k , may be calculated from the Theisen correlation using one value of latent heat (where $n = 0.38$); and then this value of k may be used in Eq. (9) to calculate the value of dL_v/dT .

Reference-Substance Plots

Basing their work on the premise that balancing the property irregularity of one substance against the similar irregularity of another will reduce the error of property correlations, several people—notably Othmer and co-workers—have developed a powerful general correlation procedure for a number of physical properties.

We'll summarize here the results that are pertinent to latent heat of

vaporization. In the equations that follow, the subscript R will in all cases refer to the reference substance.

Method 1—Othmer

In *Ind. & Eng. Chem.*, Vol. 32, p. 841 (1940), Othmer showed that a plot of $\log P_v$ vs. $\log P_{vR}$ (vapor pressure of the unknown vs. vapor pressure of a reference substance on log-log scales), if plotted for data points at the same temperatures, gives a straight line except near the critical region.

If we call m the slope of this line and use a subscript T to mean "at the same temperature", then we can write an equation to describe this relationship in the following simple form:

$$\begin{aligned} m &= (L_v/L_{vR})_T \\ &= (\log P_v)/(\log P_{vR}) \end{aligned} \quad (10)$$

This method is applicable only for moderate temperature ranges (not at high pressures).

Method 2—Othmer's Correction

In order to correct the deviations in the critical region noted above, Othmer in *Ind. & Eng. Chem.*, Vol. 34, p. 1,072 (1942) proposed plotting reduced pressures of unknown and of reference substances at the same reduced temperatures (on log-log scales).

This method gives a straight line through $P_r = 1.0$ at $P_{rR} = 1.0$, and the applicable equation is given as follows:

$$\frac{\log P_r}{\log P_{rR}} = \left[\frac{L_v/T_c}{L_{vR}/T_{cR}} \right]_{T_r} \quad (11)$$

where the T_r outside the brackets denotes "at the same reduced temperature" for numerator and denominator of the bracketed term.

Since the slope of the plotted line,

$$\log P_r / \log P_{rR}$$

was shown to be constant, we may write:

$$\left[\frac{L_v/T_c}{L_{vR}/T_{cR}} \right]_{T_r} = C \quad (12)$$

So that, knowing the latent heats of a reference substance, and a latent heat of the unknown at any temperature, we may evaluate the constant C and then calculate latent heats for the unknown at other reduced temperatures from the known values for the reference substance we have chosen.

Eq. (12) may thus be used directly without plotting; or, of

course, the suggested plot may be made and C equated to its slope.

Method 3—Gordon

Gordon in *Ind. & Eng. Chem.*, Vol. 35, p. 851 (1943) proposed the somewhat more convenient procedure of plotting $\log P_v$ vs. $\log P_{eR}$ at equal reduced temperatures. This gives a straight line through P_c at P_{eR} , which is as accurate as the corrected Othmer method all the way to the critical point.

The applicable equation can be given in this form:

$$\frac{\log P_v}{\log P_{eR}} = \left[\frac{L_v/T_c}{L_{vR}/T_{cR}} \right] T_r \quad (13)$$

Since the slope,

$$\log P_v / \log P_{eR}$$

is a constant, L_v may be calculated from the bracketed ratio of Eq. (13) by inserting L_{vR} at the same T_r .

Johnson and co-workers (*Chemistry in Canada*, March 1954) have presented a convenient nomograph for the Gordon method, using water as the reference substance.

Reference substances which have been used by workers in this field include: water, chlorine, hexane, benzene and mercury. The general criteria for selecting a suitable reference substance are:

- Availability and preciseness of the required data (P_v and L_v in this instance).

- Molecular similarity.

- The P - T range of the data.

Water is nearly always quite satisfactory as a reference substance.

How to Construct a Plot

Plotting an Othmer-Gordon type reference-substance correlation will be made considerably easier if you follow this procedure:

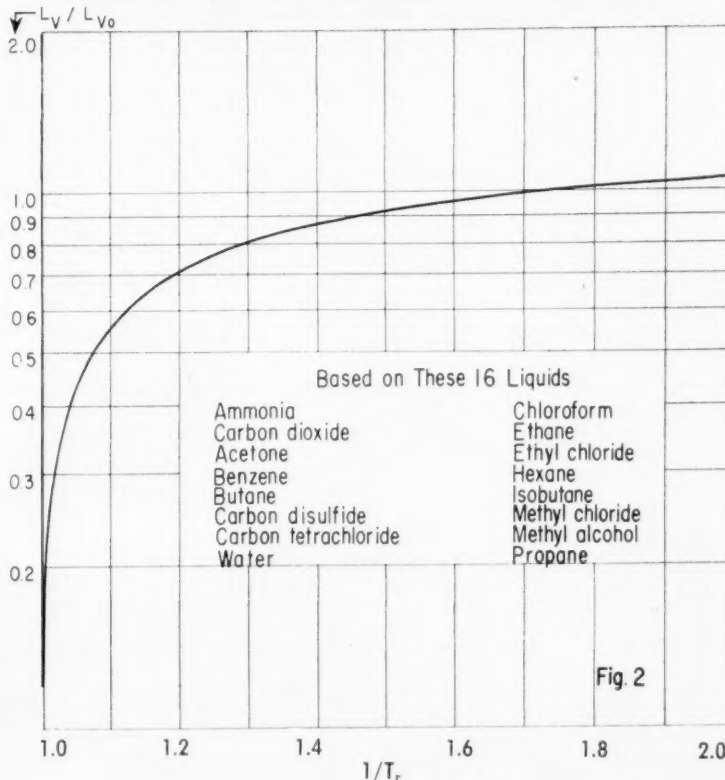
Let's take $\log P_v$ vs. $\log P_{vR}$ at equal temperatures as an example, and denote the upper horizontal line of a piece of log-log paper as the "upper abscissa" and the lower as the "lower abscissa." Then we can follow these steps.

Step 1—Plot known P_{vR} values for even values of temperature on the lower abscissa.

Step 2—Draw vertical lines to the upper abscissa from the P_{vR} points on the lower abscissa, noting the even temperatures corresponding to these P_{vR} values.

Step 3—Values of P_v for the substance being correlated are then plotted on the grid made up of the

How Heat of Vaporization Changes With Temperature



P_v ordinate and the T upper abscissa.

With this procedure you can plot P_v vs. T directly.

Some Other Correlations

Two other interesting correlation schemes which should be mentioned are those of Watson as described in *Ind. & Eng. Chem.*, Vol. 23, p. 360 (1931) and of Su as described in *Ind. & Eng. Chem.*, Vol. 38, p. 923 (1946).

Watson proposed two graphical correlations, the first of which was a plot of molar entropy of vaporization, L_v/T (Trouton's constant) vs. reduced temperature, T_r , with parametric lines of constant selection factors. These selection factors are:

$$M/\rho_b$$

where M is molecular weight; and ρ_b is liquid density at the normal atmospheric boiling point.

This correlation, however, was

not quite as accurate as his second graphical procedure. The second procedure involved plotting L_v/T vs. T_r , as before, and combining the multiplicity of "compound lines" into a single generalized curve by multiplying the entropy values for each curve by a constant factor. The resulting plot of relative L_v/T vs. T_r could be used to calculate a latent heat at T_2 from a known value at T_1 . Use this equation:

$$\frac{L_{v2}}{L_{v1}} = \left(\frac{T_2}{T_1} \right) \left(\frac{L_v/T \text{ at } T_{r2}}{L_v/T \text{ at } T_{r1}} \right)$$

Watson obtained his Theisen-type equation with $n = 0.38$ by combining the equation for his molar entropy function curve with the equation shown directly above.

Su developed a different type of correlation by introducing the compressibility-factor equation of state:

$$PV = zRT \quad (14)$$

into the Clapeyron equation:

Some Other Correlations for Heat of Vaporization vs. Temperature			
Number	Correlation	Proponent	Reference
1.	$L_V = kT^n (T_c - T)^n$	Mollier	<i>Z. ges. Kälte-Ind.</i> , 2 , p. 66 (1895).
2.	$L_V = k(1 - T_r^n)$	Thiesen	<i>Verh. d. D. Phys. Ges.</i> , 16 , p. 80 (1897).
3.	$L_V = kT^{-0.5}$	Pilling	<i>Phys. Z.</i> , 10 , p. 162 (1909).
4.	$L_V = kT [(1/T_r) - 1]$	Eggert	<i>Phys. Chem.</i> , p. 236 (1932).
5.	$L_{V1}/L_{V2} = T_1^{k1}/T_2^{k2}$	Findlay	<i>Z. phys. Chem.</i> , 41 , p. 28 (1902).
6a.	$L_i = k(1 - T_r)^{0.4295}$	Bowden & Jones	<i>Phil. Mag.</i> , 37 , p. 480 (1946).
6b.	$L_{V2}/L_{V1} = [(\rho_l - \rho_g)_2 \div (\rho_l - \rho_g)_1]^{1.287}$	Bowden & Jones	Same as above.
7.	$\frac{L_{V2}}{L_{V1}} = \left[\frac{3[P] T_1 - 4 V_b T_2}{3[P] T_1 - 4 V_b T_1} \right]^{8.4}$	Bowden	<i>J. Chem. Phys.</i> , Dec. 1955.

$$\frac{dP}{dT} = \frac{L_V}{T(V_g - V_l)}$$

resulting in:

$$L_V = szR(1 - r) \quad (15)$$

where $s = \frac{-d \ln p}{d(1/T)}$

which is the slope of a $\ln p$ vs. $(1/T)$ plot; and where $r = V_l/V_g$, the volume of the liquid divided by the volume of the gas.

Let's define a reference temperature as T_s and divide Eq. (15) by itself for a temperature T and for the reference temperature T_s . Then,

$$\frac{L_V}{L_{Vs}} = \frac{sz(1 - r)}{s_0z_0(1 - r_0)} \quad (16)$$

By assuming that the curve of $\ln p$ vs. $(1/T)$ for a given liquid is linear ($s = s_0$), and by choosing the reference temperature, T_s , in a range of low vapor pressure,

$$z_0 \text{ approximates } 1.0$$

and

$$V_{l0} \text{ is much smaller than } V_{g0}$$

Therefore,

$$L_V/L_{Vs} = z(1 - r) \quad (17)$$

This relationship holds because the term $(1 - r_0)$ drops out at low pressures because r_0 is such a small quantity.

Su further postulated that L_V/L_{Vs} is a function of reduced temperature, T , only; and he successfully checked the hypothesis with a plot of

$$\log(L_V/L_{Vs}) \text{ vs. } 1/Tr$$

We have reproduced this plot as Fig. 2 on the previous page.

Data for 15 liquids fall on the single generalized curve with an average deviation of about plus or

minus 3%. Latent heat as a function of temperature is calculated from

$$L_{V1}/L_{V2} = y_1/y_2$$

where $y = L_V/L_{Vs}$, the ordinate of the plot.

This plot substantiates the statement that the ratio of latent heats of vaporization at any two equal reduced temperatures is the same (very nearly) for all liquids.

Miscellaneous Methods

In the table above we have listed some methods for estimating the latent heat of vaporization that are, for the most part, insufficiently tested; if tested, insufficiently accurate or too inconvenient for engineering calculations compared to other available methods.

Exceptions, which are of some possible value and appear to be fairly accurate, are numbers 6 and 7. No. 6 gives a Theisen-type equation for the temperature dependence of the internal heat of vaporization L_i also calculable from the equation defining L_i :

$$L_i = L_V - P(V_g - V_l)$$

which approximates,

$$L_V - PV_g$$

and therefore,

$$L_i \text{ approximates } L_V - RT \quad (18)$$

where the symbols are all on a molar basis.

And where $L_V = \Delta H$, the enthalpy change; $L_i = \Delta E$, the change of internal energy.

The last equation in the table above gives a somewhat novel relation involving the parachor $[P]$

and molecular volume V_b . In an earlier section of this series we have discussed parachor contributions to heat capacities and we reproduced a table of these values (see *Chem. Eng.*, July 1957, p. 267).

Molecular volume, V_b is defined as follows:

$$V_b = M/\rho_b$$

where M = molecular weight and ρ_b is density of the liquid at the normal boiling point.

Coming Soon

All of our previous discussion of latent heat of vaporization has been restricted to estimating the properties of pure liquids. It may or may not apply to mixtures.

By definition, L_V for a liquid mixture is the difference of the enthalpies of the equilibrium vapor and liquid at a given condition of pressure, temperature and composition. In an early issue we plan to discuss this in much greater detail.

Reprints Available

Reprint booklets have been prepared for the first two major sections of this series of articles: "Predict Thermal Conductivity" and "Predict Heat Capacities." "Predict Thermal Conductivity" is a 20-p. booklet, Reprint No. 94, priced at 50¢/copy.

"Predict Heat Capacities" is a 32-p. booklet, Reprint No. 109, priced at 75¢/copy.

Please do not direct your requests to the author. For fastest service, kindly use the Reader Service postcards bound into every issue.

**STRONGER
and SAFER
for every
high pressure
pipeline
duty...**

**...because
they are**

drop forged

by

Vogt



Send for Catalog F-9



OTHER VOGT PRODUCTS

Drop Forged Steel Valves —
Petroleum Refinery and Chemical
Plant Equipment — Steam
Generators — Heat Exchangers —
Ice Making and
Refrigerating Equipment.

Constantly imitated but never duplicated, Vogt drop forged steel fittings and flanges have unmatched strength and toughness for your most severe pipeline duties. Laboratory controlled materials and Vogt's special forging techniques assure products which are always uniform in structure, fine grained, and free from porosity. Thereby the shocks and stresses imposed by high pressures and high temperatures are easily withstood, and with stubborn resistance to erosion and corrosion. Consult Catalog F-9 for our complete line of fittings and flanges.

For a copy of Vogt Catalog F-9 address Dept. 24A-FC

HENRY VOGT MACHINE CO., P.O. BOX 1918, LOUISVILLE 1, KENTUCKY

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia,
St. Louis, Charleston, W. Va., Cincinnati, San Francisco



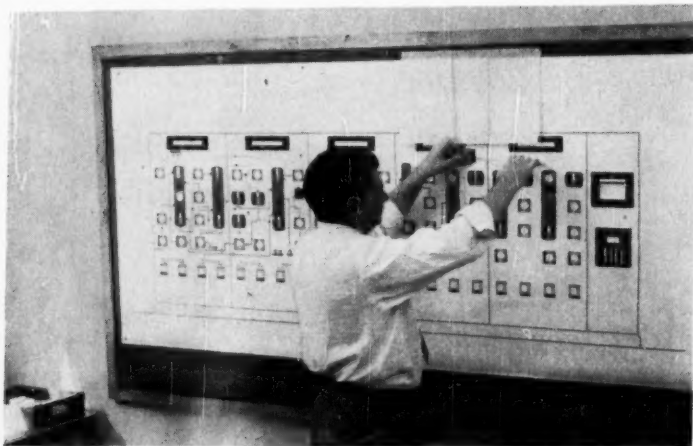
DROP FORGED STEEL

**Fittings
and Flanges**

PRACTICE ...

PLANT NOTEBOOK

EDITED BY T. R. OLIVE



Mockup for Instrument Panels

Borrowing from the scale-model idea, this instruments group uses quarter-scale cut-outs to design instrument panels.

★ **October Contest Winner by**
A. James Waldron

Division Engineer, Instrumentation, Catalytic Construction Co., Philadelphia, Pa.

In reviewing the engineering procedures of our Instrument Division, we considered the advantages of scale models as used in plant design and decided to try a similar technique for making control board layouts. The method has been highly successful and has worked to the advantage of our own company, our clients, and the instrument panel manufacturers, alike. It is equally useful for all types of panel boards including conventional, semi-graphic, graphic, and various combinations of these.

We concluded that a one-quarter scale would be suitable. This would give the same visual acuity and field of vision at 4 ft. as the plant operator would have at 12 ft. from the actual panel. Then, with the cooperation of the instrument makers we secured photographs and negatives one-quarter full size of all the necessary instruments, rapidly building up a negative library. The

prints we use are reproduced by the Xerox method which gives a dull finish of high detail, but without glare.

Our layout board is a 4 x 8-ft. fiber-board panel permanently fixed to the office wall. On this we pin TV poster cards in gray or green, laid out to scale for the

2- and 4-ft.-wide control board sections which are standard at 90 in. high above a 6-in. curb. These cards have a good surface which is reusable after a layout has been completed, photographed and the components salvaged.

For use on graphic panels we cut out symbols to scale for towers, accumulators, exchangers, vessels, heaters, and the like, employing colored background paper. Once made, they are cataloged and filed since they are reusable in other layouts. For flow lines we use $\frac{1}{4}$ -in. Scotch tape, following a consistent color code throughout the panel. Map pins serve for valve symbols, point identification, running lights, etc., and colored thumb tacks for pump symbols. We pin the control-board sections in place and affix the symbols and instruments to the background cards with small-headed dress-maker pins.

Total initial cost for the panel, pins, paper, tape and other supplies was under \$75 and is largely a non-recurring expense.

To lay out a panel the instrument engineer first creates a freehand sketch, to scale, of the proposed panel arrangement. A draftsman or engineering assistant then uses this guide in demarcating the control board sections and in pinning up the equipment symbols and instrument prints. If the panel is graphic he then runs the flow

Something New Will Be Added ...

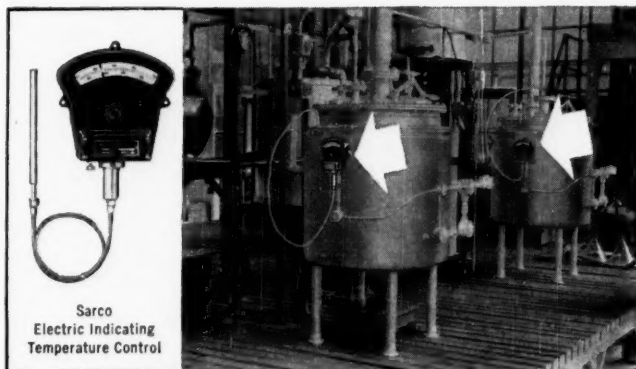
Starting with the April 7 issue, a new department to be called the Design Notebook will alternate with the Plant Notebook. This department solicits short articles primarily of interest to engineers in engineering research and development, and in process, plant and equipment design.

All articles submitted for either the Design Notebook or

the Plant Notebook will be considered at the end of each four-week period for a single \$50 prize. In each such period a winner will be selected from either the Design or the Plant area and will be published in the appropriate department.

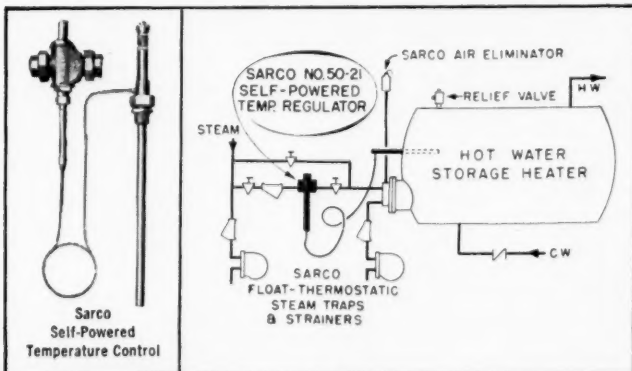
Articles received during February 1958 and later will be judged for both departments. For contest rules see p. 166.

End uncertain temperature control this simple low-cost way



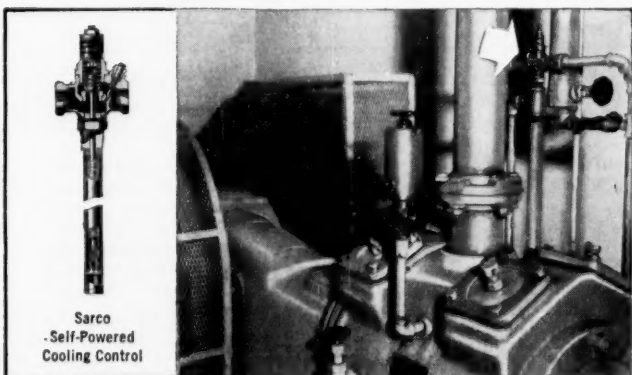
Sarco
Electric Indicating
Temperature Control

STILLS — jacket water temperature of stills held to within $\pm 1/2^\circ\text{F}$. Other typical applications — kettles, sterilizers, chemical tanks, plating tanks, processing vats, etc.



Sarco
Self-Powered
Temperature Control

HOT WATER STORAGE HEATER — desired water temperature is automatically maintained. Other typical applications — dryers, oil storage tanks, kilns, heat exchangers, etc.



Sarco
Self-Powered
Cooling Control

COMPRESSORS — controls temperature of cooling water, prevents overcooling and undercooling in compressors, aftercoolers and intercoolers. Other typical applications — small engines, condensers, ball mills, water-cooled bearings, lubricating oil coolers, etc.

SARCO Automatic Temperature Controls

Electric Indicating
and Self-Powered

Simple—Dependable
Inexpensive

YOU CAN get rid of costly, hit-or-miss manual temperature control . . . without investing in expensive equipment.

These Sarco Automatic Controls are simple, inexpensive, dependable. They're ideal for hundreds of temperature regulating jobs . . . all but the few specials that call for costly, elaborate controls.

Electric Indicating Controls by Sarco are simple, sensitive . . . perform many of the functions of much more elaborate recorder-controllers, at fraction of their cost. Responsive to temperature changes of $\pm 1/2^\circ\text{F}$. Cost . . . only about \$100.

Sarco Self-Powered Controls need no outside power source. Self-contained. Packless. $1/2$ " size temperature controller . . . only about \$100. $3/4$ " size cooling control . . . only about \$39.

Users of Sarco Controls include Colgate-Palmolive, Sinclair Refining, Swift, Ingersoll-Rand and hundreds of others.

WRITE FOR BULLETINS

- No. 1025 — Electric Indicating Temperature Controls
- No. 620 — Self-powered Temperature Controls
- No. 710 — Self-powered Cooling Controls



Sarco Company, Inc., 635 Madison Avenue
New York 22, New York

2234-B

SARCO

Automatic Temperature Control

ELECTRIC INDICATING AND SELF-POWERED TEMPERATURE CONTROLLERS • STEAM TRAPS • STRAINERS

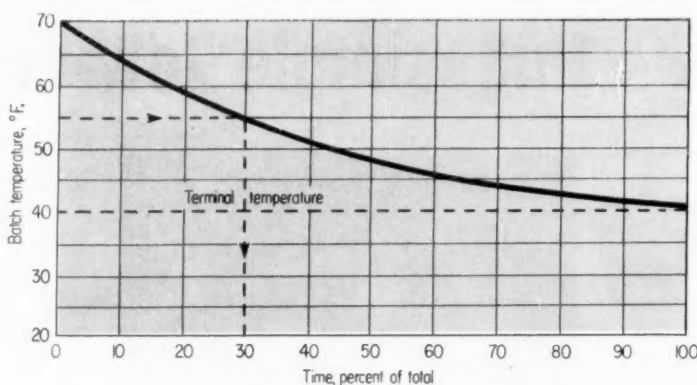
lines with tape of proper color and finally adds miscellaneous items such as flow arrows and name plate symbols. When the arrangement has been agreed on, it is photographed—in color if of the graphic type. This gives a record. If necessary, the photographs can be “blown up” and reproduced on vellum by the Photact method, producing a permanent reproducible tracing.

We use the pin-up panel idea in various ways. In making a proposal to a client, the project engineer can submit photographs of the proposed design with his proposal. The instrument engineer can submit the design for discussion and acceptance, with or without modification on the spot, to the client's management, engineers or operating men.

Since a graphic panel is an abbreviated process flowsheet, the same technique can be used in making and studying process flow diagrams. Lines can be identified by small numbered disks. Then, with the final photograph, a separate sheet gives the line numbers with the associated process data such as flow rates, molecular weights and process temperatures and pressures.

When doing the actual engineering design, the pin-up panel permits rapid comparison of various arrangements. By conference with the client's process, operating and instrument engineers, it makes it easy to arrive at an acceptable layout which is photographed and may be enlarged on vellum. It takes less time to produce a design this way than by drafting methods. For example, a 22-ft. semi-graphic control board layout for a UDEX unit was completed in less than 40 man-hr. The cost of reproducing the layout is about the same as reproducing a finished 30 x 40-in. tracing. However, it should be pointed out that making too many color prints can make the direct cost higher than by usual methods.

Other possible uses for pin-up panel photographs include getting firm bids from panel manufacturers, use of the technique for design by the panel makers themselves, and use at pre-job conferences with representatives of various construction crafts.



Percent-Time Predicts Process End

Herbert Borsvold

Senior Process Engineer, B. F. Goodrich Sponge Products Div., Shelton, Conn.

Here is a time-saving idea in determining elapsed time needed to complete certain processes.

We have a number of large tanks in which batches are mixed at atmospheric temperature, then are cooled by circulating brine in a jacket to near-freezing. We needed to find the best cycle.

In determining total cooling time for any batch we initially took frequent time-temperature readings and plotted these. When the curves reached terminal temperature we read terminal time. After repeating many times under varying conditions we found that all curves were the same shape, varying only in time to reach completion.

When we tried plotting all the curves to a percent time base—where 100% in each case was the time to reach the terminal temperature—all the curves merged into one. After that it was necessary to take only one temperature reading at a known time after the start, compare this with the chart and so find what percentage of total time the present elapsed time would be.

We have also used this method in determining drying time if initial moisture content did not vary much. It could be used in estimating time of completion of chemical reactions where degree of completion is a function of finite time.

NEXT ISSUE: Air-Excluding Constant-Head Feeder

By Thomas J. Dixon, Winner of the November Contest

★ How Readers Can Win

\$50 Prize for a Good Idea—Until further notice the Editors of *Chemical Engineering* will award \$50 each four weeks to the author of the best short article received during that period and accepted for Plant or Design Notebook.

Each period's winner will be announced in the second following issue and published in the third or fourth following issue.

\$100 Annual Prize—At the end of each year the period winners will be rejudged and the year's best awarded an additional \$100 prize.

How to Enter Contest—Any reader (except a McGraw-Hill employee) may submit as many contest entries as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable non-winning articles will be published at space rates (\$10 minimum).

Articles should interest chemical engineers in development, design or production. They may deal with useful methods, data, calculations. Address Plant & Design Notebooks, *Chemical Engineering*, 330 W. 42nd St., New York 36, N. Y.



Fig. 1559—Steel Lubricated Plug Valve for 200 W.O.G. Screwed gland type. 6" and larger valves can be furnished for gear operation.



Fig. 2433SS—Large size Stainless Steel Swing Check Valve for 150 W.P. Bolted Cap.

*Corrosion
Resistant
Valves*

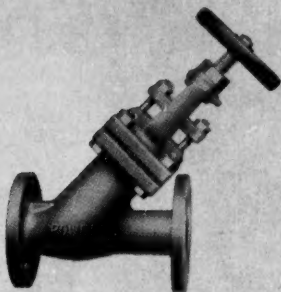


Fig. 2107—Stainless Steel "Y" Valve for 150 W.P. Plug type disc. Face to face and end flange dimensions conform to latest standards.

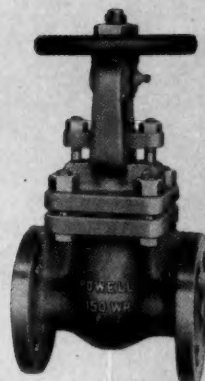


Fig. 2491—Stainless Steel Gate Valve for 150 W.P. Outside screw rising stem and yoke, solid wedge disc. Can be supplied with interchangeable split wedge disc.



Fig. 2194—Small Ni-Resist O.S. & Y. Gate Valve for 225 W.O.G. Larger sizes, flanged end, and swing check valves in Ni-Resist also available.



Fig. 1893—Large O.S. & Y. Gate Valve for Paper Mill Service. 3% Nickel Iron Body, bonnet, yoke; stainless steel stem, screwed-in seat rings; Ni-Resist wedge.



Fig. 1832—Stainless Steel Gate Valve for 200 W.P. Screwed-in bonnet, inside screw rising stem, solid wedge disc.

POWELL...

world's largest family of valves

FOR EVERY FLOW CONTROL PROBLEM Powell offers more kinds or types of valves, available in the largest variety of metals and alloys, to handle every flow control requirement. Your local valve distributor will be glad to tell you all about them. Or write to us for the full facts.

THE WM. POWELL COMPANY • Dependable Valves Since 1846 • Cincinnati 22, Ohio

★ \$100 Annual Prize Winner for 1957*

How to Control Flow of Rapid-Settling Slurries

C. W. Roos

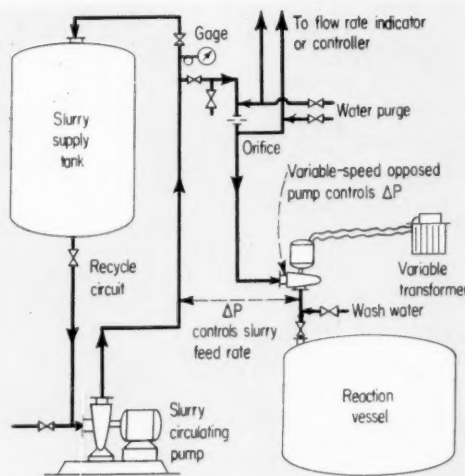
Research Department, Organic Chemicals Division, Monsanto Chemical Co., St. Louis, Mo.

Controlling slurry flow is often a difficult problem when the solids are coarse and rapid-settling. This is particularly true on a laboratory and pilot plant scale. Our solution appears practical for all cases, including large scale.

In trying to handle slurries containing 30 to 40 volume % of 50-100 mesh sodium sulfite at rates of 1-2 gph. in the laboratory and 2-5 gpm. in the pilot plant, we found control with several types of throttling valve completely unsatisfactory. Valves would either plug with solids, or the deposit would break loose on opening and pass a sudden large flow.

Our solution was to use a small variable-speed centrifugal pump connected in opposition to the desired direction of flow. That is, instead of using a valve to produce the pressure drop needed to restrain the slurry flow, we used the opposed energy of the centrifugal pump to adjust the ΔP available between the recycle line and the slurry discharge point. How this was done is diagrammed at the right.

Slurry from the feed tank is constantly recirculated at relatively high velocity by a pump. At a point near the system feed point a branch line runs to the opposed control pump and the reaction vessel. Pressure in the recycle line is sufficient to feed slurry to the reactor at somewhat over the desired rate when the control pump is off. At maximum speed the control pump



produces enough pressure to stop the slurry flow entirely.

For laboratory control we used a 1/20-hp. control pump, and three such pumps in series for the pilot plant. A standard laboratory auto-transformer is a good way to adjust the control pump speed. This can of course be made part of an automatic flow control system.

Although in larger scale operations fairly satisfactory results can be had with conventional flow-control valves, the opposed pump idea makes stable small-scale flow possible and promises improvement even in some large-scale systems.

* This article, condensed from the December 1957 issue, has been selected by the editors as the best monthly Plant Notebook winner of the year. The author has therefore received an additional prize of \$100.

Easy Silver Plating for Copper Bus Bars

Richard Minser

Cleveland 20, Ohio.

Copper bus bars, exposed to the atmosphere often become oxide-coated, which may increase electrical resistance, raise the bus-bar temperature and lead to equipment instability.

Formation of copper oxide can usually be prevented by electroplating, but this is expensive. An inexpensive solution of sodium cyanide and silver nitrate will do almost as well.

Proceed as follows: To plate 100 sq. ft. take 2 qt. of distilled water and dissolve in it 1 oz. of sodium cyanide crystals. Then dissolve $\frac{1}{2}$ oz. of silver nitrate crystals and stir thoroughly. The solution is very poisonous and rubber gloves and a respirator should always be used when handling it.

To apply, de-energize the bus and clean well with steel wool and dry wiping rags—or use a portable electric drill with a fine steel brushing wheel. This will speed up the job. Then apply the plating solution with a swab or cloths.

Acid Resisting Cements Cure Sealing Problems

Paul C. Ziemke

Engineer, Clinton, Tenn.

Sealing cements are often needed around chemical plant equipment. A good one for HCl consists of 1 part rosin, 1 part sulfur and 2 parts fireclay. A mixture of boiled linseed oil with fireclay works well with most acid vapors. The old favorite, litharge-oil cement, consists of litharge, 80 lb.; red lead, 8 lb.; flock asbestos, 6 lb.; and boiled linseed oil, 6 qt.



Top gauge shows steam pressure of 4500 pounds per sq. in. for turbine No. 6 at the Philo plant of Ohio Power Co., an operating company of American Gas and Electric Company.

New "super-pressure" steam unit requires ultra-pure water

• The higher its temperature and pressure, the more work steam will do for each pound of fuel you use. That's why power-plant steam pressures have been steadily climbing. First "super-critical pressure" unit is No. 6 in the A. G. & E. System's Philo Station. It operates at the tremendous pressure of 4500 psi (almost double previous "high") and at a new high temperature of 1150°F.

At this pressure, it requires pumps with giant 5000 hp motors, each with the power of 2 freight locomotives, just to force water into the "boiler." In fact, the water doesn't even boil or bubble; it just flashes over to an invisible gas. And at 1150°F, the steam is hot enough

to melt aluminum. Steam pipes to the turbine actually glow red under their insulation!

At Philo it is especially important to treat feedwater to remove dissolved solids that form scale and cause expensive damage. Unlike ordinary boilers, Philo's No. 6 has no drum in which dissolved solids can be concentrated and blown off. All the feedwater is flashed to steam . . . any solids would deposit in the boiler tubes or turbine.

To prevent these problems, the water for No. 6 unit is treated with a Permutit Demineralizer that reduces solids content to an average of 1/10 part per million!

You may not need water 99.99999% pure for your power, process or service requirements, but Permutit experience can help you find the right treatment for your job at the right price. Write for details to The Permutit Company, Dept. CE-1, 50 West 44th Street, New York 36, or Permutit Company of Canada, Ltd., Toronto 1, Ontario.

PERMUTIT®
rhymes with "compute it"

a division of PFAUDLER PERMUTIT INC.

Water Conditioning
Ion Exchange • Industrial Waste Treatment

Flow Formulas for Slurries

Maxey Brooke, Chemical Engineer, Sweeny, Tex.

(For author biography see Chem. Eng., July 1957, p. 318)

44. Overflow From Dorr-type Thickening Tanks

FORMULAS

For heads up to 0.03 ft.

$$V/L = H - 0.0105$$

For heads from 0.07 to 1.0 ft.

$$V/L = 3.2H^{1.485}$$

REFERENCE

Kammermeyer, *Ind. Eng. Chem.*, **36**, 202-4 (1944).

NOMENCLATURE

H = Weir head, ft.

L = Length of crest ($= 2\pi r$), ft.

r = Radial distance from center of tank, ft.

V = Overflow, cfs.

45. Streamline Flow of Slurries in Pipe

FORMULA

$$\frac{h}{L} = \frac{16t}{3pD} + \frac{\mu V}{pD^2}$$

NOTE

To obtain μ and t , put material in Stormer viscosimeter. Plot driving force W , grams, against revolutions of drum. Slope of line is S .

$$\mu = 0.0035S$$

$$t = 0.0020S$$

NOMENCLATURE

D = Diameter of pipe, ft.

h = Pressure drop, ft. of water.

L = Length of pipe, ft.

p = Density, lb./cu. ft.

t = Shearing stress at yield point, psi.

V = Velocity, fps.

μ = Viscosity, lb./sec.-ft.

REFERENCE

Babbitt and Caldwell, *Univ. Ill. Eng. Exper. Sta. Bull.*, Series 323, **35**, No. 13.

46. Friction Loss of Drilling Fluid Returning Through the Annulus

FORMULA

$$P = \frac{0.000086pLG^2}{(D_2 - D_1)(D_2^3 - D_1^3)^2}$$

REFERENCE

R. J. S. Pigott, "Drilling and Production Practice," pp. 91-103, Amer. Petrol. Inst., New York (1941).

NOMENCLATURE

D_1 = Minor annulus diameter, in.

D_2 = Major annulus diameter, in.

G = Rate of fluid circulation, gpm.

L = Length of annulus, ft.

P = Pressure loss, psi.

p = Density of fluid, lb./gal.

47. Friction Loss of Drilling Fluid Through Inside of Drill Stem

FORMULA

$$P = \frac{0.000061pLG^{1.86}}{D^{4.56}}$$

REFERENCE

R. J. S. Pigott, "Drilling and Production Practices," pp. 91-103, Amer. Petrol. Inst., New York (1941).

APPLICATION

Turbulent flow where Reynolds number is 60,000 to 300,000.

NOMENCLATURE

D = Bore diameter, in.

G = Rate of fluid circulation, gpm.

L = Length of drill stem, ft.

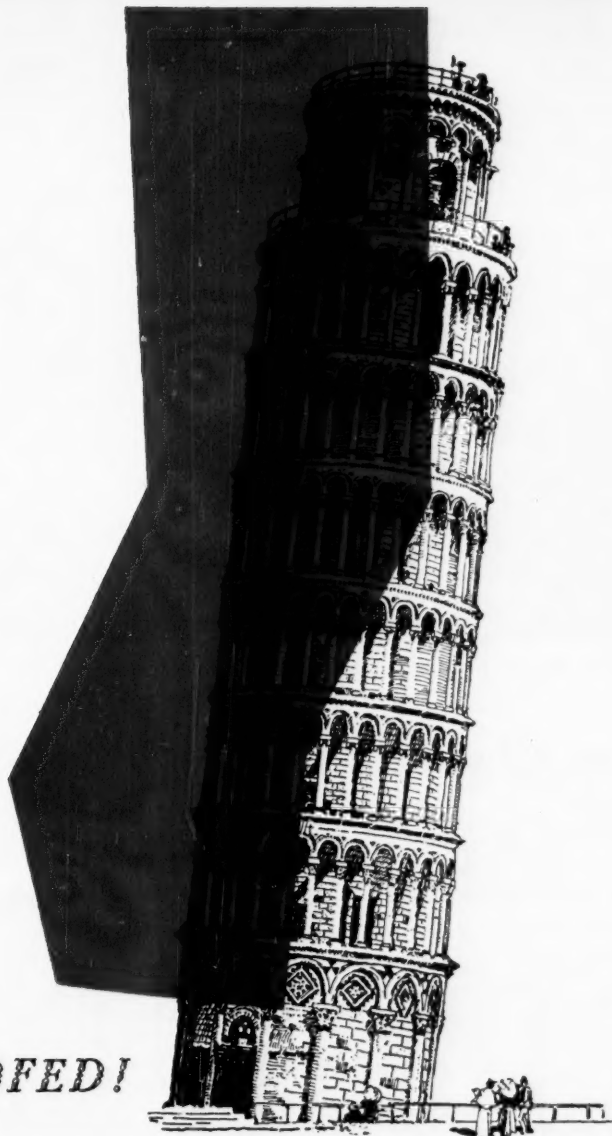
P = Pressure loss, psi.

p = Density of fluid, lb./gal.

REPRINTS OF FLOW FILE SERIES

With the next issue, the Flow File concludes the series of 50 handy flow formulas. Reprints of the entire series will be available after Feb. 1, 1958.

SOMEBODY GOOFED!



Only by a freak of fortune does the leaning tower of Pisa still stand. A faulty foundation was not apparent until the structure was three stories high. It is believed the architects were then forced to compensate by adding weight to the opposite side to save the building.

Are you building corrosion problems into your plant structures and equipment that will inevitably have to be compensated for by tremendous replacement costs? Many of these costs can be eliminated *at the planning stage* by taking advantage of the services of an expert in the field of corrosion resistant coatings... the Amercoat Sales Engineer.

The Amercoat Sales Engineer is trained in the principle that in corrosion engineering, too, foundations are all-important. You can put this factory-trained man on your staff, so to speak, without cost or obligation. His advice will be truly objective since it is based on a knowledge of all types of protective coatings and more than 43,000 case histories in our files. You can be sure that the Amercoat coating he recommends, whether vinyl, phenolic, epoxy or any other type, will be the right one for *your* job, and the most economical on the basis of cost per square foot per year.

Therefore, to effect important economies in specifying protective coatings you are cordially invited to call on your Amercoat Sales Engineer... *right at the beginning*. He will analyze all per-

tinent data concerning your corrosion problems based on our nearly 20 years of corrosion control experience, and give you a comprehensive recommendation. In addition to recommending the proper coatings, he will assist you in writing complete specifications. However, this is not the full extent of his service: he will also be available for consultation at the job site to insure proper application.

There are more than 70 Amercoat Sales Engineers and Distributors located throughout the country. It will pay you to talk to one of these men whether you are building a new plant or are interested in the efficient maintenance of existing facilities. The same service is available and equally important savings can be realized in both cases.

May we send you the name of the Amercoat man nearest you? Literature containing many helpful suggestions for the design and corrosion engineer is also available on request. Write to: Amercoat Corporation, 4809 Firestone Blvd., South Gate, Calif.

"Follow the Line of
MOST Resistance"

Amercoat

CORPORATION Dept. AA

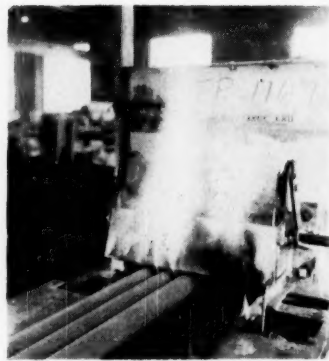
4809 Firestone Blvd., South Gate, Calif.

Houston, Texas • Jacksonville, Florida • Evanston, Illinois • Kenilworth, New Jersey

PRACTICE ...

CORROSION FORUM

EDITED BY R. B. NORDEN



HEAVY-WALL pipe, coated with paste, heads for reducing furnace . . . NICKEL plates out in furnace.

New Chemical Process Plates Resistant Nickel

Niphos process chemically plates uniform nickel coat on complicated parts impossible to electroplate. Coat is hard, ductile and nonporous.

Two commercial chemical nickel plating processes—one new, the other well established—now straddle the electroless nickel plating field.

Jumping in with both feet, Tube Reducing Corp., Wallington, N. J., offers the brightly new Niphos nickel-alloy plating method as competition to General American Transportation's well known Kanigen process (*Chem. Eng.* Mar. 1955, p. 220). **►Not Carbon Copy**—Both eliminate plating current and electrodes; both build up a hard, nonporous, corrosion-resistant coating on a low-cost base metal. Both have infinite throwing power, can plate intricate surfaces with a uniform thickness—an impossibility with electrolytic methods.

But Niphos (developed by N. Y. Testing Lab.) is not a carbon copy of Kanigen. There are basic differences in techniques and properties.

Tube Reducing paints, dips or

sprays a paste of nickel oxide, diammonium phosphate and water on base metal, which must be free of all grease, scale and dirt. The paste dries in the atmosphere; parts are then transferred to a dry-hydrogen controlled-atmosphere furnace. At elevated temperatures (around 1,650 F.) nickel separates from the oxide. Some of this material fuses and alloys with the base metal.

►Batch and Continuous—Parts, after treatment, have a silver-like appearance. Usually the coating is 1-mil thick, but several cycles of application and firing can put on thicker coatings. Process can be continuous or batch—continuous in a furnace fed by conveyors or belts. Coating contains about 98% nickel, 2% phosphorus.

General American uses a radically different method, based on a plating solution of nickel sulfate, sodium hypophosphite and water. Plating takes place at

215 F. during catalytic reduction of nickel by the phosphite. All parts must be cleaned of grease and scale before treatment.

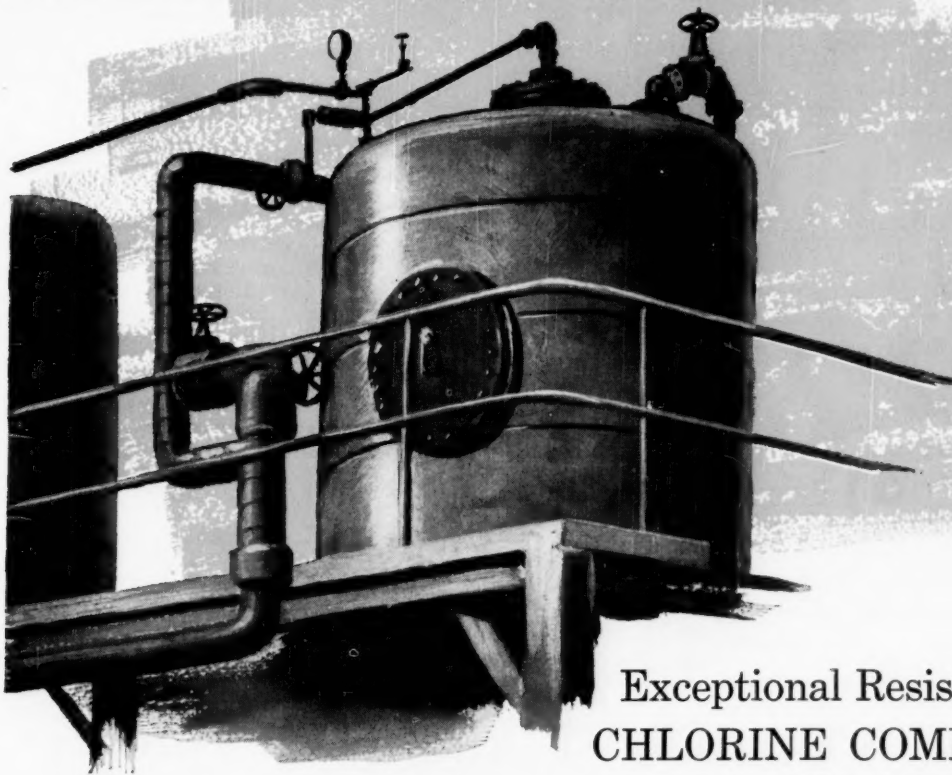
Since the plating material is liquid, parts are easily coated by barrel, rack or jig (pumping solution through the piece) methods. After coating, liquid goes to flash evaporators then to regenerating tanks. Here concentrated caustic, nickel sulfate and sodium hypophosphite solutions are added to restore strength.

Heat treatment of the coated parts at 750 F. greatly increases hardness and corrosion resistance. Coating has about 91.3% nickel, 8.7% phosphorus.

►Machinable Coating—Both coatings are practically pore free—considerably less porous than electrolytically deposited nickel.

Tube Reducing claims their coating will stand up to temperatures of 1,150 F. And a 180-degree bend will not cause flaking or peeling (because of the metallurgical bond between the coating and parent metal). Coating is not as hard as Kanigen (1,000 vs. 500 Vickers), but Kanigen has lower ductility and

HAYNES Alloys solve the *tough* corrosion problems



Exceptional Resistance to CHLORINE COMPOUNDS at 300 deg. F.



Built-In Corrosion Resistance—Sections of 11-gage HASTELLOY alloy C sheet are welded to the interior of a vessel to protect it from attack by HCl and chlorine compounds.

A large preheater lined with HASTELLOY alloy C is giving exceptional service while operating under severely corrosive conditions in a chemical plant. Used in the production of benzene hexachloride, the lined vessel resists the attack of hydrochloric acid, trichlor benzene and other chlorine compounds at 300 deg. F. temperatures.

Vessels lined with HASTELLOY alloy C have been used for this application for two to four years. It has been estimated that, with periodic maintenance, the nickel-base alloy will last almost indefinitely.

A recently published booklet describes the corrosion-resistant characteristics of HASTELLOY alloys. Send for your free copy. Write Haynes Stellite Company, Distribution Section, 30-20 Thomson Avenue, Long Island City, N. Y.

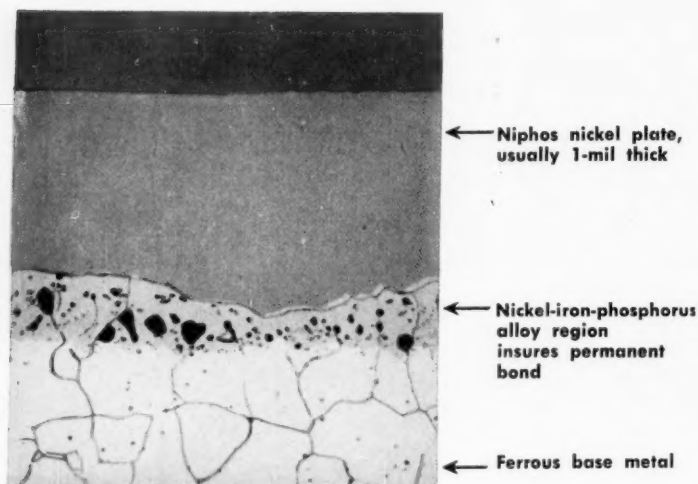
HAYNES ALLOYS

HAYNES STELLITE COMPANY

Division of Union Carbide Corporation
Kokomo, Indiana



"Haynes," "Hastelloy" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.



is not recommended for use over 750 F.

This relatively high ductility means the Nippos coating can be machined. Coated rotor shafts have been machined to dimensions. It's possible to stamp and form sheet metal after Nippos processing. Also, coated wire has been drawn through dies without damage.

► **Costs Get Complicated**—Tube Reducing is tight lipped about costs, but Nippos clad 1½-in. extra heavy pipe runs about \$1/ft., compared with ordinary black pipe at \$0.50/ft. This is competitive with Kanigen costs.

Actually the economics of plating is a complicated subject. Costs depend on complexity, size and value of the parts to be plated. For very simple parts, particularly flat pieces, chemical coating is about 4 to 5 times more expensive than electrolytic nickel. As complexity of parts increase, the cost of electrolytic nickel goes up rapidly while chemical nickel costs remain fairly constant.* In many cases for pipe, chemical and electrolytic nickel coatings are competitive on a cost basis.

► **Resistant to Many Chemicals**—Nippos, like Kanigen, is corrosion resistant to all materials which don't attack nickel. This includes most solvents, sodium

hydroxide, phenol, chromic acid.

It is not recommended for molten metals such as aluminum, lead, antimony, bismuth, tin, zinc or for cupric chloride, ferric chloride, hypochlorites, silver nitrate and concentrated sulfurous acid. The coating is presently undergoing intensive corrosion tests.

► **No Panacea**—This is not to say that Nippos coating is without disadvantages, other than costs.

Nippos contains phosphorus which presents some welding difficulties: Phosphorus in a stainless weld will produce cracking. Tube Reducing claims mild steel coated parts can be welded with a mild steel rod, covered with a 312 stainless alloy, without any great difficulty. Stainless can be deposited directly, but phosphorus pick-up temperatures have to be watched and controlled very carefully. Of course, Nippos coated parts can be brazed easily.

Also, any material to be Nippos coated must be compatible with the high temperatures involved (post heat treatment is under investigation). Very large pieces of equipment are difficult to coat since they call for large furnaces (there is no size limitation for Kanigen). And the furnaces pose other problems: on intricate, thin-sectioned parts contour molds with clamping devices have to be used to prevent distortion.

In many cases Nippos nickel alloy can be applied while stress relieving a part. The firing temperature is higher than usual stress-relief temperatures, but the few hundred extra degrees brings most steels into the normalizing range. Tube Reducing claims the higher temperatures do not detract from the physical properties of most steels.

So far Nippos has only been successfully applied to ferrous metals. Kanigen can be applied to iron, steels, copper, aluminum, brass and bronze, but not to tin, lead, cadmium, zinc or antimony.

► **Special Applications**—Tube Reducing, following the lead of General American Transportation, actually stresses the point that chemical nickel is not just a substitute for electroplate. It has unique properties such as high hardness and no porosity. And it can be applied to very complicated pieces of equipment.

Still young in this field, Tube Reducing plans to sublicense the process. And, as an example of the potential of chemical nickel coatings, Tube Reducing is treating 1,000,000 ft. of oil tanker steam heater coils for carrying sour crude.

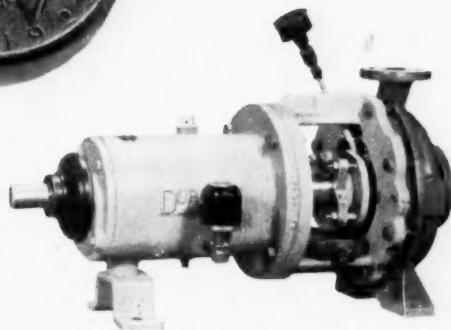
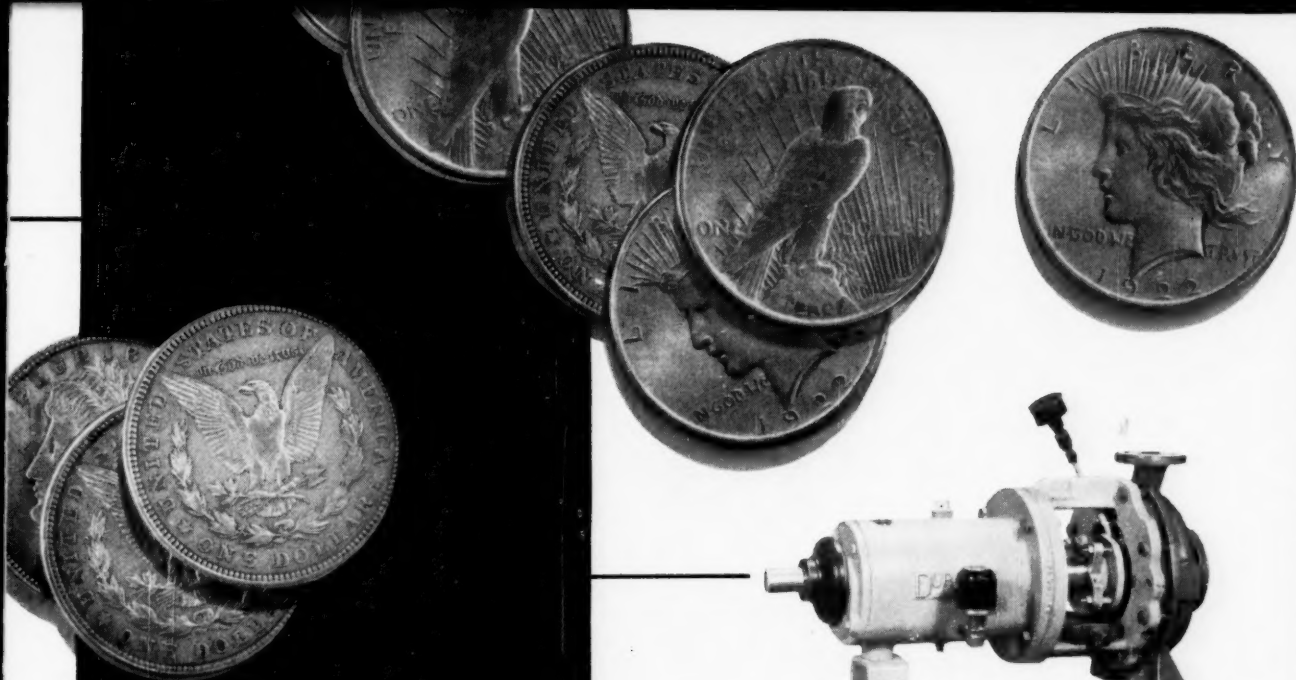
Growing Interest in Niobium Metal . . .

As we push for higher and higher operating temperatures, problems of making better high-temperature materials become more acute. During recent years we've seen the development of iron, nickel and cobalt base superalloys with excellent strengths up to about 1,700 F. For higher temperatures metallurgists are now turning to the higher melting metals. One of these, niobium (formerly known as columbium) is catching a lot of attention.

Recent research indicates niobium has excellent promise as a structural material for temperatures around 1,800 F. Actually niobium doesn't lose its high-temperature strength until about 2,000 F. At that temperature it has the same strength as molybdenum, and is several times stronger than nickel or cobalt base alloys.

Leading the flurry of activity

* During the Nippos furnace treatment, creep or light flow of nickel alloy takes place around corners and into small holes.



SPECIFY SERIES **H** DURCOPUMPS WITH SIMPLE **3** STEP MAINTENANCE

For dependability under severe pumping conditions, and easy one-trade, three step maintenance, buy the pump that saves you money. Series H Durcopumps are built to handle the tough corrosives with maximum efficiency and minimum down time.

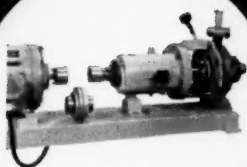
Versatile Durco interchangeability provides optimum pumping performance with a reduced spare parts inventory. Simplified design permits quick removal for periodic inspection without disturbing piping or electrical connections.

Series H Durcopumps are built to handle heads to 345 ft. and capacities to 3000 gpm in a wide range of corrosion resisting alloys.

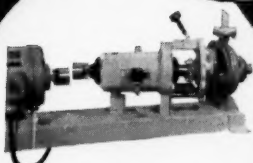
To save real dollars in pumping costs, call the nearest Durco engineer or write:

THE DURIRON COMPANY, INC.
Dayton, Ohio

Branch Offices: Baltimore, Boston, Buffalo, Chicago, Cleveland, Detroit, Houston, Knoxville, Los Angeles, New York, Pensacola, Fla., Philadelphia and Pittsburgh



1. Remove spacer from coupling.



2. Remove cap screws.



3. Remove the pump. Suction and discharge lines undisturbed, motor and alignment unaffected.

DURCO
CORROSION RESISTING
ALLOYS & EQUIPMENT

*the mark of dependability
in tough chemical service... everywhere*

in this field are two large companies both announcing new developments:

• **Du Pont.** In a move designed to step up progress in niobium, Du Pont has entered into a joint development agreement with Thompson Products, Inc., Cleveland, Ohio, for work in the fields of jet aircraft and missiles. Thompson Products will develop forging and other fabrication techniques for Du Pont developed niobium alloys.

In pure form, niobium is very ductile, unless common gases such as nitrogen, hydrogen, or oxygen are introduced. A one lb., $\frac{3}{4}$ -in. niobium ingot can be cold rolled into 0.001-in. thick foil without annealing.

Pure niobium oxidizes rapidly at high temperatures. But by alloying, both strength and oxidation resistance at high temperatures have been greatly increased.

• **Westinghouse.** Using a technique called "cage zone melting" Westinghouse scientists have produced ultrapure niobium. There's not much known about the metal, and Westinghouse has a program underway to look into basic properties. First they had to have some pure material to work with. The new lab process does the trick.

Essentially, impurities are removed by refining the metal at a white-hot temperature of 4,400 F. under very high vacuum.

A rectangular bar of impure niobium stands vertically on a movable platform, which can move the bar up and down inside a coil of heavy copper tubing. Coil and platform are enclosed in a sealed vessel having a vacuum only four billionths atmospheric pressure.

When a strong, high-frequency electrical current is sent through the coil, corresponding currents

are induced in the bar, which melts from the inside out. The four corners of the bar do not melt, but form a "cage" within which molten niobium is trapped. The niobium bar thus serves as its own crucible within which white-hot metal is refined.

As the bar rises through the coil, a molten zone of niobium travels down the bar from top to bottom, melting the bar progressively throughout its entire length. Successive passes through the coil result in niobium of increasing purity.

. . . And New Tantalum Developments

Tantalum has excellent resistance to corrosive acids and vapors. It's been available for some time, but recent applications in atomic reactors has sparked many new developments.

Kennametal Inc., Latrobe, Pa., has recently announced availability of 99.9% pure tantalum in commercial quantities. Bars, sheets, foil and wire, in addition to granules, are offered. Kennametal also produces niobium at Latrobe.

One of the pioneer producers of tantalum, Fansteel Metallurgical Corp., is now producing the metal in a new plant at Muskogee, Okla. Effect of this is a reduction in delivery times for sheet and equipment from 15 to 18 months, down to 43 to 47 weeks. Fansteel hopes to reduce this further this spring.

First Nickel-Lined Chemical Barges

All this interest in new metals doesn't mean proven materials are being neglected.

Making up an integrated petrochemical tow are the first barges built with nickel-lined compartments for carrying glycerine and hexylene glycol—never before moved by barge. Barges move material from Shell Chemical's Houston plant to a Chicago terminal.

The four barges in the tow have a total capacity of 60,000 bbl. Three of the four have a total of nine nickel-lined steel compartments.



Pyrocera Tubing Now Available in Quantity

Tubing, in diameters from $\frac{1}{8}$ to $\frac{1}{2}$ -in., made from Pyrocera, is available from Corning Glass. Industrial applications should be first in heat exchangers, and then as diameters increase, in

high-temperature process piping.

Tubing is pure white and opaque, with thermal shock resistance equivalent to fused silica. Flexural strengths of the tubing are 17,000-23,000 psi.



PERMOBOND COVERINGS



The Case of the Frustrated Sea Monster

Put steel propeller shafts in contact with bronze bearings. Then add salt water and you create a *monster*.

The three have combined to produce an electrolytic action which pits the steel shaft, weakening it and inviting breakage under the severe stresses involved in the radical maneuvering of fighting ships.

In such great new super-carriers as the "Forrestal" and "Saratoga" (as in their predecessor of decades ago, the first "Lexington") this "monster" of electrolysis can't exist. Propeller shafts are covered with U. S. Permabond®, the rubber lining that defies electrolytic attack and corrosion.

Permabond Covering and Linings can be applied to any metal section, large or small, simple or complex. When unit is too large to ship, our field crew will install and vulcanize Permabond right in your own plant, or install Permabond as original equipment in the fabricator's plant. Where special conditions occur, a wide range of synthetic Permabond lining stocks is available.

If there's a monster on sea or land, corroding your operations, get in touch with any of the 28 "U. S." District Sales Offices or write us at Rockefeller Center, New York 20, N. Y.

In Canada, Dominion Rubber Co., Ltd.



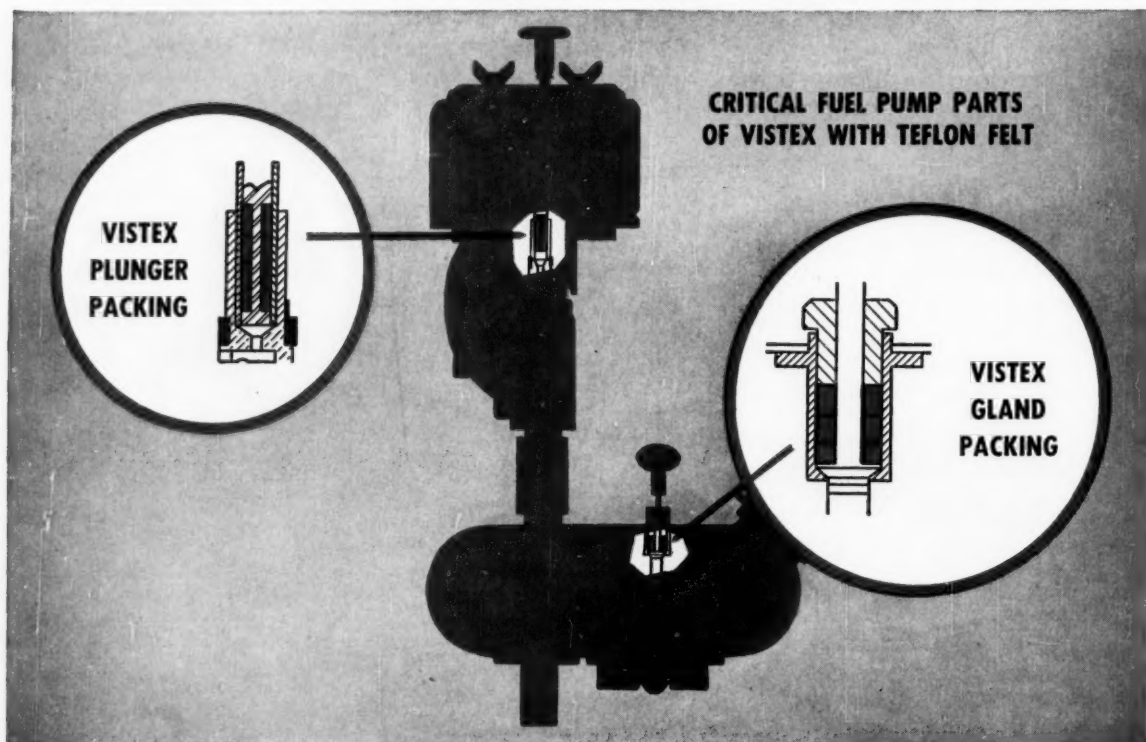
Mechanical Goods Division

United States Rubber

SEE THINGS YOU NEVER SAW BEFORE. VISIT U. S. RUBBER'S NEW EXHIBIT HALL, ROCKEFELLER CENTER, N. Y.

VISTEX WITH TEFLON FELTS

for positive . . . self-lubricating seals



Are dependable seals your problem?

Here's a new way to solve even the toughest ones . . . *American's Versatile Vistex-with-Teflon Felts!*

Felted of Teflon reinforced synthetic fibres, these advanced-type, self-lubricating Felts are setting new performance standards under both high and low temperature operating conditions. They resist *all* acids, alkalis, aliphatic and aromatic compounds . . . maintaining their thermal stability in applications up to 420°F!

You get better, stronger seals . . . Vistex-with-Teflon Felts withstand up to 5,000 psi . . . eliminating troublesome lateral plastic flow and sealing on polished or irregular surfaces with only minimum pressure.

Vistex-with-Teflon Felts can be precision cut without ravelling or fraying . . . having a very high tear value. Due to their great strength they are reusable for *even* greater economy.

Available in 36" x 36" sheets with thicknesses of 1/16", 1/32", 1/64" or as cut gaskets, strips and washers . . . quality Vistex-with-Teflon Felts can economically and efficiently meet your specific requirements.

Save time — consult our engineering staff for assistance in choosing the correct Felt. Remember: It's the largest, *most* experienced staff in the industry . . . and it's backed up with the largest, *most* modern laboratory facilities in the industry.

Write today for technical Bulletin VT-2-856 . . . on your company letterhead, please.

OTHER VISTEX FELTS BY AMERICAN

In addition to Teflon, Vistex Felts are also impregnated with such polymeric compounds as:

**HYCAR • NEOPRENE • BUNA S
NATURAL RUBBER • RED NEOPRENE**

. . . to meet individual chemical and physical conditions.

Shouldn't you investigate the advantages of these Felts, too? They are already being used in thousands of difficult applications throughout every major industry.



General Offices and Engineering
and Research Laboratories
317 Glenville Road, Glenville, Conn.

Chemical Engineering

People

JAN. 13, 1958

Department Index

You & Your Job.....	181
Technical Bookshelf	186
Briefly Noted	188
Meet Your Authors.....	190
Letters; Pro & Con.....	197
Names in the News.....	202
Firms in the News.....	210

Letters to the boss spark creativity..... 179

Twice a year, professional and managerial men in this firm sit down and write a letter to their immediate bosses. They all say this "planned creativity" pays off.

Technical Bookshelf 186

Ion Exchangers in Organic & Biochemistry by Calmon and Kressman . . . Catalysis by Emmett . . . Engineering Data Book offered by the Nat'l Gasoline Supply Men's Assn.

Meet Your Authors..... 190

Link on selecting ejectors . . . Lowenstein on rupture disk size . . . Process economist Finlayson . . . Management expert Pacifico . . . Simkin and Hurd on H_2O_2 properties.

Letters: Pro & Con..... 197

On: . . . Microdyne dust collector . . . the importance of chemical metallurgy . . . industrial odor control . . . economic barriers for fermentation glycerine in the U. S. . .

Names in the News..... 202

Nat Kessler of A. E. Staley Mfg. Co. . . Davison Chemical's Myrick . . . Princeton University's Dean Joseph Elgin . . . Dow Chemical's J. R. Stein . . . Callery Chemical's Brandt.

Firms in the News..... 210

Monsanto has relocated its general offices in St. Louis . . . Crucible Steel is now full owner of Rem-Cru Titanium . . . Celanese opens new polyolefin pilot research lab. . .



solves your jointing problem

The original compressed asbestos jointing, Klingerit was first manufactured over seventy years ago, and is used today in ships, refineries, chemical and power plants all over the world.

Specially suitable for HIGH PRESSURE, HIGH TEMPERATURE problems, it resists the action of steam, hot and cold water, hot and cold oils, petrol, benzene, the by-products of the coal industry, most acids, and chemicals in general. It will not burn, disintegrate or squeeze out. Thicknesses from .008" to $\frac{1}{4}$ ". Sheet sizes to 60" x 160".

Available from distributors in all principal cities.



For descriptive leaflets and literature write to:—

RICHARD KLINGER INC. 550, FOURTH AVENUE, BROOKLYN 15, NEW YORK
SOUTH 8-6747

Manufacturing Licensees for Canada
JOSEPH ROBB & COMPANY LIMITED, 5575, COTE ST. PAUL ROAD, MONTREAL, 20, CANADA
Telephone: WILBANK 3181

Branches at: SYDNEY, HALIFAX, OTTAWA, TORONTO, HAMILTON, WINNIPEG, EDMONTON, VANCOUVER, QUEBEC CITY
RICHARD KLINGER LIMITED, KLINGERIT WORKS, SIDCUP, KENT, ENGLAND

GA39, 58, 1

EDITED BY R. F. FREMED

PEOPLE ...
YOU & YOUR JOB



How "Dear Boss" Letters Spawn Creativity

This inexpensive and uncomplicated program pays off in these three areas: planned creativity; more effective use of engineering manpower; higher profits.

Carl Pacifico, Vice-President, American Alcolac Corp., Baltimore*

Admittedly, we're a small company and what works for us may not work in one of the giant organizations. But we've developed a new engineering management tool that is working rather smoothly now.

There's no secret to it and for what it's worth to other engineering managers—as well as to engineers who are being managed—here's what it is, how it operates and what we have accomplished since we started using this program.

We call it the "Semi-Annual Letter Program" and it requires

of each of our professional and managerial staff that they sit down every six months and write a letter to their immediate superiors. The letter, conceived by the president of our company, V. Blinoff, follows a simple fill-in type outline.

Here Are the Objectives

Our official explanation of the objectives for and the mechanics of this program runs something like this:

"Most people are not accustomed to planning. They often expend effort without considering whether or not it is being

used in the most efficient manner. A busy man may say that he is too busy to plan, not realizing that proper planning will always reduce his work load. Even more important: Planning helps assure that effort is applied in the right direction. The greatest effort in a direction opposite to the departmental objectives is worse than wasted.

"Because most people encounter difficulties in planning—in spite of its benefits—an outline has been prepared to guide you in writing your semi-annual planning letters. These letters are due before May 1st and before Nov. 1st of each year."

An Additional Objective

This semi-annual letter, as we use it, has an additional objective. It encourages our technical and managerial personnel to re-

* Meet your author on page 194.

view all aspects of the company that concern them and then to bring any aspect they may desire to the attention of their superiors.

Of course, the technical man or the manager is always free to do this; but this letter provides a semi-annual encouragement. It provides, also, an extra (and a more direct) channel of communication.

Simple Operating Mechanics

Our plan is uncomplicated. As mentioned above the letters must be written to the supplied outline. So actually it's just a simple matter of filling in the blanks.

Each man supplies two copies of his letter. The supervisor is charged with the responsibility of giving the letter his most careful consideration. He inscribes his comments and returns one copy to the assistant.

Then superior and assistant sit down for personal discussion and face-to-face resolution of all areas of difference.

Here's a Sample Letter

It would be unfair for me to disclose the contents of any of the letters that have been written to me. For illustration purposes, let me use an edited version of the latest letter that I have written to my own boss.

Q.—What are the objectives of my superior?

A.—To maintain, even under the most adverse conditions foreseeable, an organization that can provide products needed by industry, jobs needed by employees and profits required for growth.

To select the objectives of the organization.

To select among the courses proposed by department heads those most likely to attain the objectives established.

To select specific areas of activity in research and marketing.

To select, train, motivate and

supervise the proper personnel required to meet these objectives, and to select the proper relationship among their functions and activities (that is, an organization chart).

Q.—What are my general objectives?

A.—In the area of commercial development: uncover suitable projects; find markets for products; establish specifications, prices and extent of effort to be devoted to each new product in order to obtain maximum return; assist in the selection of suitable fields of activity in research and marketing.

In the area of company development: handle special assignments on subjects such as communications, morale, etc.; increase company prestige through proper handling of publicity and advertising.

Q.—What are my objectives for the next six months?

A.—(Omitted, since they would disclose details of my company's operations.)

Q.—How is my department organized and what are the responsibilities of each member? Has each a working plan? What specific programs for personal development have been established for each?

A.—(Company confidential.)

Q.—What is my budget. Are there any comments on its adequacy?

A.—Authorization to hire a market development man and one more salesman should give us adequate personnel for the present. We may need additional secretarial help after these men are available for a few months.

Q.—What are my major tools, including space? What additional tools or space will be required in the next six months?

A.—Space O.K. in New York and Chicago. Probably be adequate in Baltimore. Will need space for Ernie here.

Q.—How should my achievements be rated?

A.—Sales volume, considering the situation; ratio of sales costs to sales volume; efficiency in selecting products and markets for our company; specific accounts and markets developed; efficiency in supervising my department; new company procedures that increase over-all efficiency; general knowledge of the chemical industry that helps solve problems in other departments; extent of company prestige, as influenced by publicity and advertising.

Q.—What improvement can I suggest?

A.—In the quality of personnel:

- Improve selection through establishing job descriptions and man descriptions.

- Work on establishing Alcolac as a good place to work, in order to attract outstanding men to our company.

- Employ a consulting psychologist to improve inter-relationships.

- Publicize our new employees in our advertisements, both for their morale and to attract new people.

In the area of management techniques:

- Urgent that we install a project-control system.

- Continue education of management personnel through attendance at conferences and courses.

- Expand management contacts at meetings of American executives for improved understanding of U. S. industry.

- Spend occasional days (or evenings) discussing special management techniques and their application at Alcolac.

In other fields of activity, we should expand our contacts with consultants to turn up interesting new projects. Also, it is urgent that we find a way to put to use in our own company the accumulated technical knowledge of our associated companies.

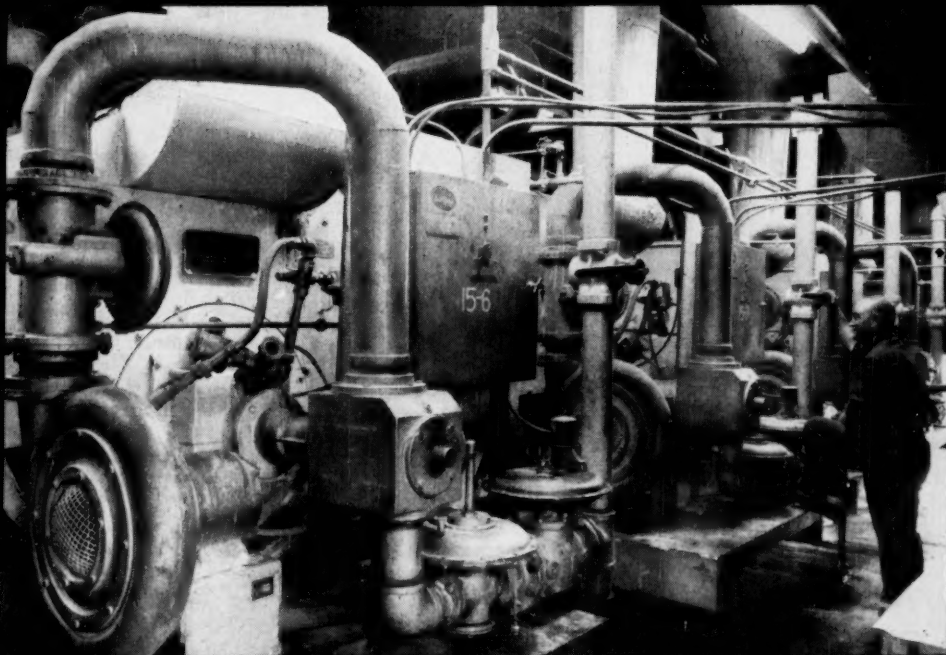
Q.—What changes will improve my efficiency?

A.—Closer contact with the laboratory is required. Routine problems take too much of my time. Eventually a junior man who devotes part time to product development would relieve me.

Next Issue: How to Run a More Effective Meeting

Want to be a better supervisor in the eyes of your assistants, in the eyes of higher management and, incidentally, in your own eyes? A good way to take a long step in that direction is to become known as a person who can prepare and conduct a good, productive department or committee meeting. In our next issue an expert will share some of his years of meeting know-how with you.

Four 100-hp boilers pay for themselves in two years at Stalwart



Eclipse gas-fired boilers save costs, hold pressure constant in vulcanizing process

This satisfied Eclipse customer, Stalwart Rubber Company, Bedford, Ohio, tells us that four 100-hp Eclipse Gas-Fired "Super-Matic" Scotch Steamboilerplants have saved enough to pay for themselves in the two years they have been used . . . even though the previous boilers were fired with low-cost coal. These big savings are due partly to high efficiency of the new units and partly to the fact that one part-time day man takes care of the Eclipse boilers. For the huge old boilers replaced, supervision by four engineers around the clock was necessary under Ohio law. Ohio does not require a licensed engineer for these small, multiple, automatically operated units.

Furthermore, Stalwart now has the steady steam

pressure so important in the operation of its big vulcanizers. High peak demands were too much for the previous boilers, but steam pressure is easily held constant by the new Eclipse units. Higher production and a better, more uniform product results.

Stalwart also has gotten away from soot and dust, saved space and been able to generally smooth up the plant operation. Four boilers are used in the wintertime — during the summer two carry the load.

Write for catalogs illustrating and fully describing 11 horizontal models and 28 vertical Steamboilerplants, process-engineered for best results on every job.

ECLIPSE FUEL ENGINEERING CO., 1121 Buchanan Street, Rockford, Ill.

ECLIPSE FUEL ENGINEERING CO. OF CANADA, LTD., 20 Upjohn Road, Don Mills, Ontario



Q.—How am I preparing for advancement?

A.—During the past six months: studied industrial psychology and mathematical techniques.

During the next six months, I plan to study mathematical techniques and the financial aspects of business. Also, I plan to review organic chemistry and make a thorough study of surfactant uses in industry.

Q.—Am I happy with my job? What could be done to improve my happiness?

A.—(Confidential.)

Make a Projection Chart

After completing the letter itself, each man then sketches in a chart blocked out in weeks for the next six months. On the chart he lists for each project that he is concerned with a rough guess of when he will be spending time on that project.

By superimposing the individual charts upon each other it's possible to get a bird's-eye view of where the technical effort of any department is being concentrated at any particular time. This can be one of the most valuable byproducts of the program from the standpoint of engineering management.

A Frank Appraisal

Our program has been in operation for over two years now and naturally, we have formed some opinions on and made some appraisals of its effectiveness. For what they may be worth to you, here are some of them:

1. The idea is not accepted very well the first time it is introduced. Most people resent planning.

2. It takes at least three of these semi-annual letters until the supervisor and his assistant finally see things the same way.

3. The letters have a definite therapeutic value. Some types of assistants take the opportunity to list their gripes. Obviously, this provides an opportunity to bring them out in the open and to get them solved.

4. In almost all cases, the assistant has never considered the objectives of his superior. This is obviously a serious problem as his own objectives can only be completely useful when they

mesh with and supplement the objectives of his superior.

5. Setting up specific objectives forces a man to a more concrete realization of what he can accomplish in a given period of time. The first time or two that he sets up these letters, he greatly overestimates what he actually can do in a given period of time.

The question about departmental organization and the responsibilities of each member of the department is answered only by those men who have assistants reporting to them. The question requires an answer indicating that the manager not only has planned work for these assistants but also has planned some projects for their personal professional development. It focuses attention on the weaknesses which each of us have and the responsibility of the superior to help a man overcome these weaknesses.

Rating achievements is especially important. For example, a superior may be rating a development man on the number of new accounts he brings in, whereas that man may himself be judging his own performance on the amount of useful information he obtains.

Am I happy with my job? If answered frankly, this can be a very useful question. Probably this question will never be answered in complete truth and frankness. Nevertheless, careful analysis of the answers to this question can lead an experienced engineering manager to the roots of trouble.

To Sum Up

The effect of this program on bringing the thinking of a group together is little short of startling. With general objectives, near-term goals and criteria of performance agreed upon, the members of the group are all pulling in the same direction with a minimum of wasted time and motion.

While it will never be a popular program at the lower echelons because of the dislike for planning, management will find that the plan produces substantial results within 18 months at negligible cost and with little expenditure of management effort.

NEW UNION

. . . In Gestation Stage

Formation of a new engineering union has moved a step closer to reality. Meeting in Los Angeles, steering committee of the Engineers and Scientists Guild raced through a draft of a constitution.

Committee members agreed on the spirit of the document which would create a new national collective bargaining force of engineers and allied employees.

Still to be worked out are the legal and technical language of the constitution and a budget which will be acceptable to all participating and observing associations. These associations include in their representative jurisdiction some 22,000 engineers and engineering employees in private industry and governmental agencies.

About half this membership would be comprised of groups which splintered from the Engineers and Scientists of America last May when that organization put the accent on professionalism by voting to exclude technicians, draftsmen and others without engineering degrees.

The rebel faction contends that this move served to de-emphasize the collective bargaining function of ESA, and as a direct result they are trying to form ESG to include both professional and technical people.

YOUTH

. . . Wants to Work

Contradicting findings of current youth surveys which have indicated that young men willing to work hard and start at the bottom are practically nonexistent, we have an interesting report from the American Management Assn.

A Cleveland company ran the following advertisement:

"Opportunity for hard-working young man ready to start at the bottom and, by initiative and self-reliance, work his way up as far as his ability and determination will permit."

Within 24 hours the job was filled.

JENKINS

O.S.&Y. U-BOLT GATE

**MADE BETTER
THAN
NEED
BE . . .**

Costs Less to Use

YOU PAY NO MORE for the extra quality you see in every part of a Jenkins Outside Screw & Yoke U-Bolt Gate valve. Yet longer life and reduced maintenance is bound to result from the extra ruggedness, the precision manufacture and unique design features which Jenkins puts into these popular, general utility valves.

Choose the Outside Screw & Yoke pattern for services where spindle threads must be kept out of the destructive effects of fluids in the line; where spindle threads must be cleaned and lubricated regularly or where a rising spindle is needed to indicate wedge position.

Choose JENKINS, whether O.S. & Y. or Inside Screw pattern, for valves built to save maintenance dollars.

WIDE RANGE OF JENKINS U-BOLT GATES
GET FOLDER NO. 207 which describes Inside Screw and O.S. & Y. patterns . . . Iron Body with Bronze or Stainless Steel Mounting . . . All-Iron and Ni-Resist with type 316 Stainless Steel trim. Ask your local Jenkins Distributor or write Jenkins Bros., 100 Park Avenue, New York 17.

JENKINS

LOOK FOR THE JENKINS DIAMOND

VALVES



Sold Through Leading Distributors Everywhere

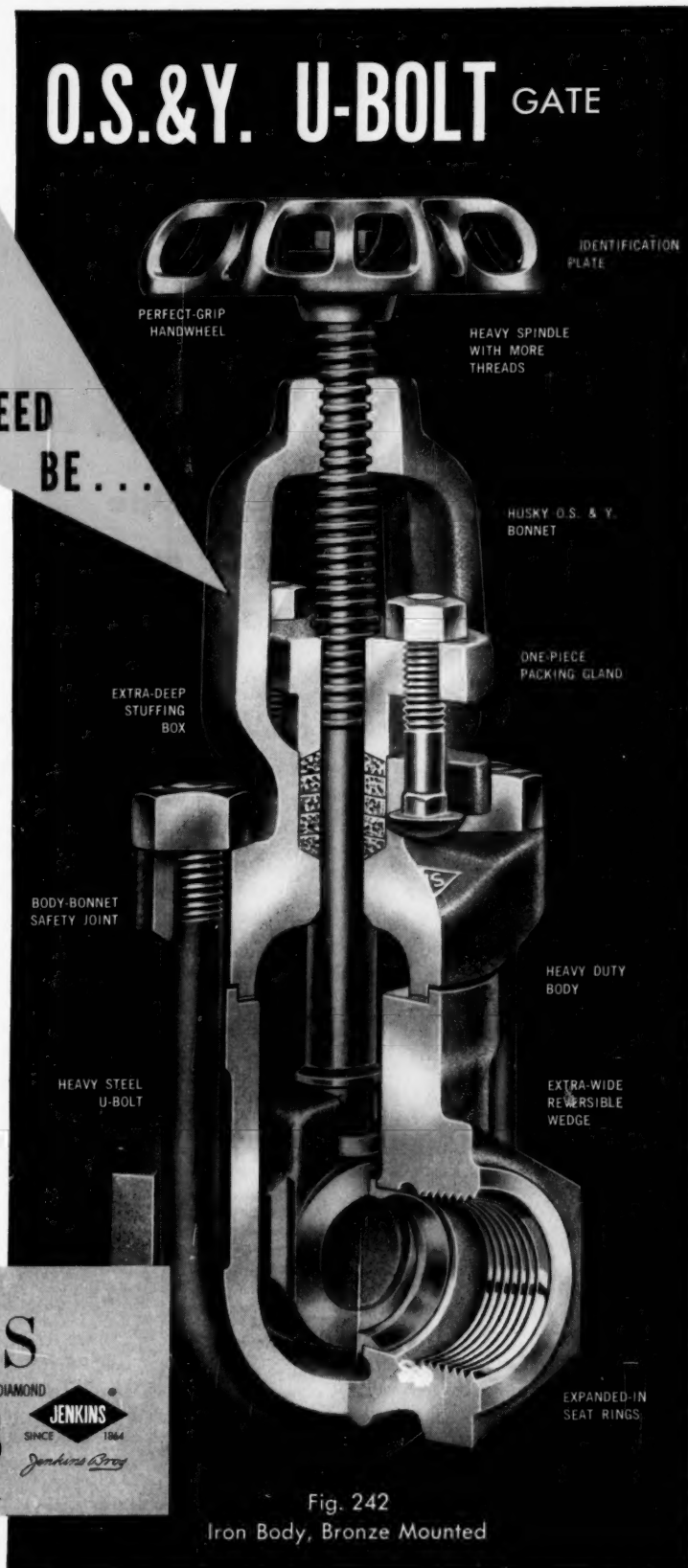


Fig. 242
Iron Body, Bronze Mounted

when these hands are old and weak

the pipe
will still be
sound

New ACE RIVICLOR® Corrosion-resistant plastic piping

RIVICLOR, newest of all rigid plastic pipe, heads the list for resistance to chemicals and excellent aging characteristics . . . plus high strength, toughness and easy workability.

Riviclор is unplasticized polyvinyl chloride, specially formulated for process piping. Non-toxic, non-flammable, excellent insulating properties. Only half weight of aluminum. Never needs painting. Smooth inner surfaces give you high flow rates with low loss of head.

Use Riviclор for all in-plant piping of mild or strong corrosives at normal temperatures . . . for liquid lines where "sweating" or corrosive vapors are problems . . . for underground piping. Pipe, fittings, diaphragm valves from 1/2" to 2".

Ask for Technical Bulletin CE-56.

Approved
For Use
With
Drinking
Water



ABBREVIATED TABLE OF CHEMICAL RESISTANCE

ACIDS		BASES		MISCELLANEOUS		
Acetic 50%	S	Ammonium Hydroxide 28%	S	Ethyl Alcohol	S	Carbon Tetrachloride S
Chromic 25%	S	Sodium Hydroxide 50%	S	Methyl Ethyl Ketone	U	Plating Solutions S
Hydrochloric 38%	S	HALOGENS		Gasoline	S	Photographic Solutions S
Hydrofluoric 50%	L	Sodium Chloride Sat.	S	Mineral Oil	S	KEY: S—Satisfactory
Nitric 20%	S	Ferric Chloride	S	Animal Oil	S	L—Limited to certain applications
Sulphuric 50%	S	Sodium Hypochlorite 5%	S	Vegetable Oil	S	U—Unsuitable
Sulphuric 98%	S			Phenol 10%	S	
				Chlorine 5%	L	
				Alum	S	

ACE

processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY

Ace Avenue • Butler, New Jersey
DIVISION OF AMERACE CORPORATION

PEOPLE . . .

TECHNICAL

Engineer's Opportunity

CATALYSIS, VOL. 5. Edited by Paul H. Emmett. Reinhold Publishing Corp., New York. 542 pages. \$15. Reviewed by V. A. Kallchevsky

Volume five of this comprehensive and up-to-date survey is directly related to the manufacture of petrochemicals and to the modern methods of petroleum processing. It's the fifth volume of the series on catalysis edited by the well-known authority on the subject. Additional volumes are in preparation.

The book is divided into the following chapters: Reactions of carbon monoxide (M. Orchin and I. Wender); the oxo reaction (I. Wender, H. W. Sternberg and M. Orchin); direct catalytic synthesis of higher alcohols from carbon monoxide and hydrogen (G. Natta, U. Colombo and I. Pasquon); the catalytic hydrogenation of aromatic compounds (H. A. Smith); hydrogen isotopes in the study of hydrogenation and exchange (T. I. Taylor); and the hydrodesulfurization of liquid petroleum fractions (J. B. McKinley).

The chapters on the reactions of carbon monoxide (the Oxo reaction in particular) and on hydrodesulfurization of petroleum fractions are of special interest to persons working in these fields whether they are engaged in research and development or in the design and operation of commercial plants. Theory and the industrial applications of these reactions are discussed in considerable detail. In each case, the scope and limitations are stated with emphasis on generalities.

The book is especially well documented and the reader has no difficulty in locating important articles and selected patents on specific subjects. This makes the book of much value both to scientists and engineers.

The book gives the engineer an exceptional opportunity to increase his knowledge of catalysts and to study variables, including catalyst poisons, which are in-

BOOKSHELF

J. B. BACON

volved in catalytic reactions of hydrocarbons and petroleum fractions.

Principles underlying the operation of the various hydrosulfurization processes are clearly and impartially presented and details having no relation to process performance are omitted. Material presented should assist the engineer in reducing construction and operating costs of modern catalytic units which became an integral part of the petroleum and petrochemical industries.

The editing of the book is beyond reproach.

Valuable Source Book

ENGINEERING DATA BOOK, 7TH ED. Published by Natural Gasoline Supply Men's Assn. 324 pages. \$5.

This book is a source of valuable data to engineers in the process industries.

Included for the first time are tabulations of orifice factors for pipes up to 30" in diameter; sections on water treatment by chemical means, on cooling towers, and on gas dehydration; and tables of allowable working pressures for refinery, oil and gas transmission piping. Also, generalized enthalpy charts for light hydrocarbons, viscosity data for hydrocarbon gases and petroleum fractions, and thermal conductivity data for hydrocarbons make their initial appearance.

The most obvious and worthwhile change over the last edition is a ten-fold increase in the coverage of equilibrium ratios (K values). Exactly half of the book's 300 data pages are devoted to this subject. K values are related to composition through the concept of convergence pressure. Plots of K vs. pressure at various temperatures and at nine values of convergence pressure ranging from 600 to 20,000 psia. are presented for 14 different hydrocarbons (paraffins and olefins) and for N_2 , CO_2 , and H_2S . Equilibrium ratios for nine

NO SHAPE TOO SCREWY

for ACE Rubber Linings and Coverings

Most any size or shape of special processing equipment can be lined or covered with quality ACE hard or soft rubber . . . for meticulous protection against corrosion, to resist abrasive wear, or to provide electrical insulation. Ask for recommendations.



STOP
VALVE
CORROSION
at lower cost



There's an ACE hard rubber, rubber-lined, or plastic-lined valve for every corrosion application. Sizes from 2" to 24". Diaphragm, gate and check types. Free Bulletin CE-52 lists chemicals that can be handled.



FOR HIGH PRESSURES
OR BIG PIPE LINES

ACE Rubber-Lined Steel . . . strength and pressures of steel plus chemical resistance of hard rubber. Excellent for alkalis, most inorganic acids, many organic acids, all salts, bleaches. Sizes 1 1/4" to 24" and up. Bulletin CE-52.

Take the
guesswork
out of

CORROSION

No need for "trial and error" to find the right rubber or plastic chemical equipment. Consult American Hard Rubber Company first. Now eleven basic materials. Wide range of temperatures, pressures, strength. Backed by a century of experience. Write for facts today, or ask for name of Distributor.



ACE-HIDE
ACID PAIL

Practically Indestructible

Its made of a new rubber-plastic material that's tough, resilient, suitable for handling most acids and alkalis. 3-gal. size. Easy-pour, drip-proof spout. Also 1-qt. and 2-qt. dippers, hard rubber bottles, etc. Write for name of nearest dealer.



processing equipment of rubber and plastics

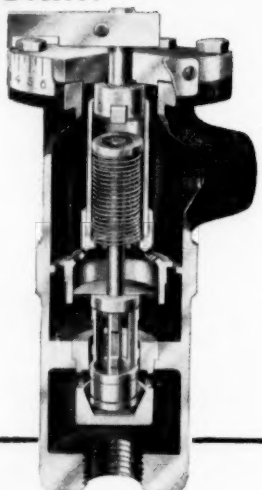
AMERICAN HARD RUBBER COMPANY

Ace Avenue • Butler, New Jersey
DIVISION OF AMERACE CORPORATION

Need Adjustable-Constant Flow Rates?

**DON'T
Build a
System...**

Install a
Kates*

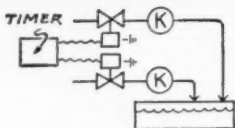


* KATES Direct-Acting Flow Rate Regulators are complete in themselves, requiring no outside connections except inlet-outlet piping; for light slurries, clear liquids, and many suspensions; hold constant flow despite 125-psi jumps or drops in inlet-to-outlet pressure.

Economy may not be your principal reason for selecting a Kates regulator, but added to the single-unit compactness and no-hunt, no-lag features it is certainly a valued extra. And you will save on maintenance, too. Kates regulators are designed to eliminate wire-drawing, and the only packing is on the infrequently-used dial stem.

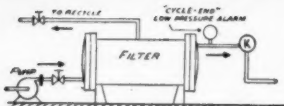
Write us for more details on the unique operating principles and practical design features of Kates flow rate regulators. But first, here are some of the problems that Kates has solved for others—*economically*.

BATCH PROCESS MEASUREMENT



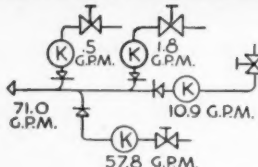
Automatic batch processes are easy when liquid ingredients are fed through Kates regulators and timer-operated solenoid valves. One timer can control all additives since individual flow rates can be set at each regulator. And it is easy to change proportions; just change the regulator settings.

PRESSURE FILTRATION CONTROL



As filter cake builds up, a constant valve-jockeying is needed to smooth out flow. A Kates control in the effluent compensates for rising pressure drop, keeps filter at best rating.

PROPORTIONATE BLENDING CONTROL



Where many ingredients go into one blend, and must be in exact proportion, a control system for each ingredient would cost plenty. But a Kates control on each feed does the job inexpensively, and each unit can be reset for a blend change.

Write for Technical Bulletin — **TODAY**

Kates

W. A. KATES COMPANY

Department D.
430 Waukegan Rd.
Deerfield, Illinois

BOOKSHELF . . .

other systems—mostly H_2 in various hydrocarbons—complete this extensive section.—THA

Of Some Interest

ION EXCHANGERS IN ORGANIC AND BIOCHEMISTRY. Edited by Calvin Calmon and T. R. E. Kressman. Interscience Publishers, Inc., New York. 761 pages. \$15.

Reviewed by Alex Lesuk

In a commendable and successful attempt to summarize recent advances as well as to present fundamental information in this field of ion exchange, the editors have enlisted the cooperation of 37 experts to write a book of as many chapters.

The subject matter of the book is presented in three parts. The first is concerned with the fundamental considerations of the nature, properties, and behavior of ion exchange materials.

The second part is concerned largely with laboratory techniques and apparatus. A chapter on some of the characteristics of the majority of the commercially available ion exchangers is also included in this section.

The final section of the book a collection of 28 monographs, treats some subjects of more direct interest to the readers of these columns: ion exchangers as catalysts, the isolation of antibiotics and alkaloids, the commercial purification of sugars, polyhydric alcohols, alcoholic beverages, fruit juices, milk and milk products and water. Equipment and process design and other technological considerations are generally omitted.

Aside from the fundamental considerations presented in this volume, the chemical engineer will find only a minor portion of the contents to be of direct interest. However, the biochemist and, to a lesser degree, the organic chemist and the analyst will find this excellent book of tremendous value.

Virtually every chapter in the book is clearly written and, in general, each of the chapters in the final section may be read or studied effectively without reference to those which immediately precede or follow.

BRIEFLY NOTED

AIR AND WATER POLLUTION ABATEMENT CONFERENCE, 1957 Proceedings. 131 pp. *Manufacturing Chemists' Assn.* 1625 Eye St. N. W., Washington 6, D. C. Contains 14 papers dealing with pollution control.

ATOMIC ENERGY FACTS. 216 pp. *Atomic Energy Commission, Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.* \$2. Compiles up-to-date information for management and others interested in atomic energy field.

DETERMINATION AND CORRELATION OF FLOW CAPACITIES OF PNEUMATIC COMPONENTS. 10 pp. *Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.* 10¢. Enlarges the concept of previous publications, replacing "flow factor" with "area factor."

NATIONAL SYMPOSIUM ON INSTRUMENTAL METHODS OF ANALYSIS, 1957 SYMPOSIUM. *Instrument Society of America, 313 Sixth Avenue, Pittsburgh, Pa.,* \$5. to ISA members, \$7.50 to non-members. For people interested in development or use of instrument methods of analysis in manufacturing and industrial application.

MORE NEW BOOKS

SOVIET EDUCATION FOR SCIENCE AND TECHNOLOGY. By Alexander G. Korol. Wiley and Massachusetts Institute of Technology. \$8.50.

INDUSTRIAL CHEMICALS, 2nd ed. By W. L. Faith, Donald B. Keyes and Ronald L. Clark. Wiley. \$16.

CATALYSIS IN PRACTICE. Edited by Charles H. Collier. Reinhold. \$3.95.

INORGANIC SYNTHESIS, Vol. 5, Edited by Therald Moeller. McGraw-Hill. \$6.

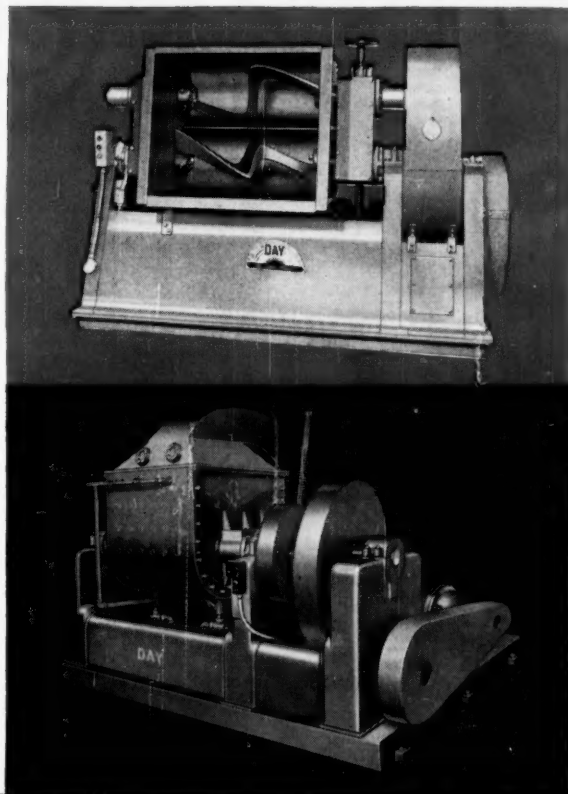
CONCISE GUIDE TO PLASTICS. By Herbert R. Simonds. Reinhold. \$6.95.

HIGHER OXO ALCOHOLS. By Lewis F. Hatch. Wiley. \$4.50.

NUCLEAR ENERGY IN THE SOUTH. Edited by Redding S. Sugg, Jr. Louisiana State University Press. \$3.50.

DAY IMPERIAL

DAY MOGUL



DAY

**double arm mixers give
thorough dispersion
dependable operation
fast production**

DAY IMPERIAL mixers meet every requirement for heavy duty kneading and mixing, and are the result of sound engineering, superior design and superior construction. Counter rotating agitators with 3 to 2 ratio insure thorough mixing and shearing action. Air seal stuffing boxes protect your product from contamination, and guard the heavy duty bearings from damage by abrasive mixtures. Everything about a DAY mixer is heavy, rigid and built for long service. In 35, 50, 100, 150 gal. working capacities—plain or jacketed tanks, tilting or non-tilting. **DAY MOGUL** mixers are the "big boys" in our line. Their effortless mixing of extra heavy materials, like rocket fuel, flushed colors, pastes, putties, furnace cements, etc., means speedy, economical production. They have all the design features of the Imperial and are available in 2½, 5, 100, 150, 200, 300, 600 gal. working capacities.

The popularity of DAY mixers is proven by the high favor they enjoy in hundreds of plants in many industries. They are attractively priced and require a minimum of operation and maintenance expense. Make DAY your one source for all your process equipment requirements. New illustrated Bulletins on complete line of mixing, blending, milling, sifting equipment FREE on request.

The J. H. DAY Co.
Division of Cleveland Automatic Machine Company

4926 BEECH STREET,

CINCINNATI 12, OHIO

TO IMPROVE SOLIDS-LIQUID SEPARATION PROCESSES

Consider

MULTI-METAL FILTER MEDIA

Wire Cloth and Filter Cloth in all alloys, and every degree of density down to 400 mesh and in all weaves.

"Neva-Clog" perforated sheet metal medium functions on edge filtration principle.

"Mykro-Pore" electrodeposited filter medium in pure nickel, with round or slotted holes; wide range of opening sizes, hole patterns, open area ratios and thicknesses.

MULTI-METAL FABRICATIONS

A complete, comprehensive and versatile service in converting filter media into filtration or other processing components or complete units:

Filter leaves for all pressure and vacuum filters; screens for plate and frame presses; tubular filter elements; strainers; vibrating screens; baskets; hoppers; cylinders; elements for dryers, catalyst units, washers, mixers, etc., and complete apparatus or machinery.



Catalog 57 gives helpful, practical information on Multi-Metal research, engineering and product services for better methods and means of solids-liquid separation. Write for a free copy.

MULTI-METAL WIRE CLOTH CO., INC.

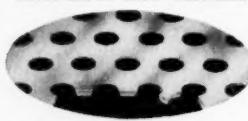
1353 GARRISON AVENUE • NEW YORK 59, N. Y.



"Multibraid" (magnified); dense, strong, woven filter cloth.



"Neva-Clog" (magnified to show flow); perforated sheet metal filter medium.



"Mykro-Pore" (magnified cross-section); electrodeposited filter medium.



"Rim-Lok" leaf for vertical or horizontal filters.



"Sweetland" filter leaf.



"Multi-Plate" fabricated filter press plate.



Elements for gas stripping process.



Vibrating screen disc.

PEOPLE . . .

MEET YOUR



Kenneth Finlayson

RATE ECONOMIC FACTORS BY IMPORTANCE. PAGE 151

"Too often, supervisors spend too much time and energy 'putting out fires,'" says Author Kenneth Finlayson. "That is," he continues, "they jump from one emergency to the next, with little opportunity to relate the significance of their immediate actions to their main goal—improved return on investment."

With this in mind, Finlayson set about to turn out the current article, designed to help management control its efforts in relation to the overall economic picture.

Finlayson is now employed at Du Pont's Edge Moor, Del., unit, as an economic analyst. Duties include long range cost forecasting, analyses of costs, evaluation of project economics and coordination of cost reduction efforts.

His interest in economics was fostered quite early in his professional life. He graduated from Newark College of Engineering in 1933—in the midst of the depression. The return on the investment in a college education looked a bit meagre to him at the time—even with his degree in chemical engineering.

First full-time job was with Du Pont in Newark, N. J., making lithopane and colors. And, he has been with Du Pont ever since—working in operations such as group supervisor, area supervisor and process improvement engineer.

With rapid postwar expansion of production, introduction of new products, rising wages and higher prices, his efforts were

AUTHORS

M. A. GIBBONS

soon concentrated more and more in the field of economic analyses.

Current activities are along the line of preparing the way for the day when electronic computers can be used for "management by exception" as well as for process control and automatic accounting.

Finlayson reports that his background includes "no professional honors" and that his talents "do not run to political activities. In fact," he tells us, "the main problem with hobbies seems to be to find the time away from the job of making a living and raising four children." He's the proud father of three girls, aged 20, 17, 10 and one boy, 14.

However, now and then, he manages to squeeze in a few moments of oil painting, dabbling in astronomy and plane flying.



C. O. Hurd






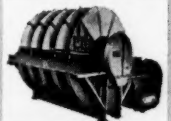
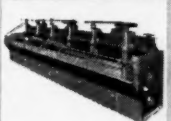


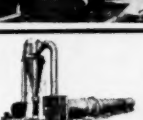
HEAT CONTENT & V. P. OF H_2O_2 . PAGE 155

Shell Development Co. gleaned Author Charles Owen Hurd from the University of California's Class of '34 and has hung on to him ever since.

When Hurd joined Shell at Emeryville, Calif., in 1934, he took on a junior chemist's post. Since that time he has come up through the ranks of assistant chemist and junior engineer to his present post of engineer that he attained in 1940.

Specifically, his work has concentrated in these areas: thermodynamics of chemical reactions; generalizations of heat capacities

DENVER PROCESS EQUIPMENT

DENVER • (patented) SUPER AGITATORS and MIXERS		3' x 3' to 20' x 20'	Patented standpipe around propeller shaft assures positive agitation and circulation. Patented wearing plate prevents sand-up on shut-down. Heavy duty as well as acid-proof construction is available in both open-type, air lift and Super Agitator models. Please write for Bulletin No. A2-B4.
DENVER Steel-Head BALL MILL		3' x 2' to 8' x 20'	A Denver Steel-Head Ball Mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. B2-B13.
DENVER Automatic SAMPLERS		16" to 60" Cutter Travel	Heavy duty units, extra rigid track and ball-bearing wheels assure positive travel and timing of sample cutter. Available in stainless steel for acid and corrosive service. Wet and dry cutters. Central Control Panel for multiple samplers. Bulletin No. S1-B4.
DENVER Forced-Feed JAW CRUSHER		2 1/4" x 3 1/2" to 36" x 48"	Cast Steel Frame, manganese jaw and cheek plates. Large diameter shafts reduce shaft deflection and thus increase life of heavy-duty, oversize roller bearings in bumper. Setting easily controlled. Please write for Bulletin No. C12-B12.
DENVER Wet Reagent FEEDER		0 cc to 2000 cc	Accurately meters minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Handwheel adjustment to control amount of liquid is simple and accurate. Used in multiples for higher capacities. Please write for Bulletin No. F6-B9.
DENVER Disc FILTER		1 Disc, 2' to 12 Disc, 9'	Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Filters. Please write for Bulletin No. FG-B1.
DENVER "Sub-A" FLOTATION		Laboratory and Commercial	Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire flotation job; because they give maximum recovery at a low cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-B81.
DENVER Wilfley Concentration TABLES		5 to 150 T/24 Hrs.	A mechanically operated, longitudinally reciprocating table consisting of a deck having a plane surface partly riffled and a tilting device. It separates materials into bands and handles the coarsest sands with excellent results. Ideal for separation of groups of particles having a similar range of specific gravities. Write for Bulletin No. T1-B3.
DENVER LABORATORY EQUIPMENT		Batch or Continuous	Batch and continuous test models of Crushers, Screens, Ball Mills, Pulverizers, Rod Mills, Classifiers, Agitators and Mixers, Pulp Distributors, Feeders, Flotation Machines, Pumps, Thickeners, Filters, Dryers, Tables, Samplers. Results obtained on Denver Laboratory Equipment can be duplicated by commercial machines. Please write for Bulletin No. LG3-B10.
DENVER Standard DRYERS		2' x 15' to 5' x 40' and larger	Available in several types: Direct Heat, Indirect Heat, and Steam Tube. Let DECO Engineers solve your drying problem. No dryer problem too small or too large. Please write for Bulletin No. D4-B2.

"The firm that makes its friends happier, healthier and wealthier"

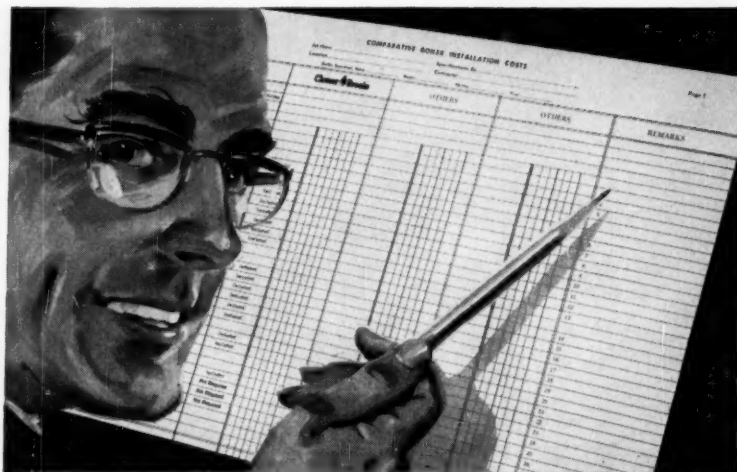


DENVER EQUIPMENT COMPANY

1400 17th Street • Phone CHerry 4-4466 • Denver 17, Colo.

See Our New Catalog Starting on Page 647 CEC

Before you buy any boiler compare quoted prices with **REAL COSTS**



New Cleaver-Brooks cost analyzer clears "quotation" confusion — reveals ALL costs

Get *all* the costs... the *real* costs... down on paper before you recommend or specify a boiler to your clients. On many boiler installations "quoted prices" seldom agree with the total costs, as you may have learned. This is frequently the case with so-called "built-up" boilers assembled on the site.

Cleaver-Brooks' cost analysis enables you to compare all material costs (boiler, steam trim, burner, refractory, controls and other equipment) and installation labor costs. You'll know the "real costs" on the complete installation before you start.

Real eye-opener

The figures you'll see may be startling. In most cases the cost analysis proves a Cleaver-Brooks costs *less*. On-job time is dras-

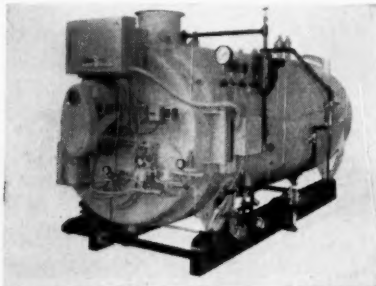
tically reduced because Cleaver-Brooks packaged units are fully assembled, ready to install. Cleaver-Brooks boilers give you more in performance, too... each boiler is fully fire-tested at the factory under load, tuned to peak economy. Starting service and on-the-job operator training by authorized field engineers further decreases your over-all costs.

Contact your Cleaver-Brooks agent

Once you add up all the benefits of a Cleaver-Brooks "one-cost" package... the proved trouble-free economy of exclusive four-pass, forced-draft design, you'll find it pays over and over to analyze costs carefully before you buy. See your Cleaver-Brooks agent for details or write Cleaver-Brooks Company, 345 East Keefe Avenue, Milwaukee 12, Wis., Dept. A.

.....

Choose from 19 sizes, 130 models, 15 to 600 hp. Oil, gas and combination oil/gas fired — steam or hot, water for heating or processing.



Cleaver-Brooks
ORIGINATORS OF SELF-
CONTAINED BOILERS

AUTHORS . . .

and heat contents; generalizations of vapor pressures and heats of vaporization; thermodynamic properties of specific compounds; and generalizations of thermodynamic properties.

He is a registered professional chemical engineer in the State of California.



Donald J. Simkin

HEAT CONTENT & V. P. OF
H₂O. PAGE 155

Both Donald J. Simkin and Co-Author Charles Hurd were specialists in thermodynamics for Shell Development Co. when the firm called upon them for a special assignment in their field.

That assignment was to work out the properties of pure H₂O₂ for the firm's process engineers who were designing a new hydrogen peroxide plant. In view of the general interest—both military and civilian—in the properties of hydrogen peroxide, Shell decided to release the information. Hence, the current article.

Simkin was born in New York and went to California while young enough to attend high school out there. He did undergraduate work at UCLA and at the University of California in Berkeley. After earning a B.S. in chemistry in 1945, he went on to earn an M.S. in chemical engineering in 1948.

For a time, he taught organic chemistry at Berkeley. Later, he took on specialized graduate training in combustion at Massachusetts Institute of Technology.

In 1949, Simkin joined Shell Development at Emeryville, Calif. He worked in research for eight years on distillation, extraction, catalytic and thermal

cracking projects. Simkin has also published extensively in these fields.

Last March, Simkin left Shell to join Marquardt Aircraft Co., as a senior thermodynamics engineer. At present, he is senior development engineer working mainly on combustion, fuels and ram-jet propulsion problems.

Memberships include the American Institute of Chemical Engineers, the American Rocket Society, the Combustion Institute and the University of California Alumni Association.

Simkin is married and has one son, age 5. So, of course, he's also active in the local Parent-Teachers Association. Though never outside of the United States, Simkin speaks five languages with some fluency. He's a student of the history of the Middle East and collects U.S. stamps as well as records.

Naturally, because of their locale, the Simkins enjoy exploring Southern California and relaxing in their backyard swimming pool—kidney shaped, of course.



C. G. Linck

SELECTING EJECTORS FOR
HIGH VACUUM. PAGE 145

C. G. Linck has spent about twenty years working in the heat exchanger and vacuum field. Assignments have included such specific areas as cost analysis, estimating, production control, engineering and plant management.

Of the fifteen years he has spent with his present employer—Graham Manufacturing Co.—he has worked the last five as plant manager.

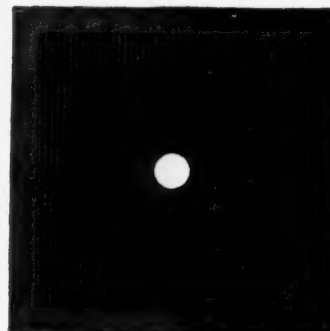
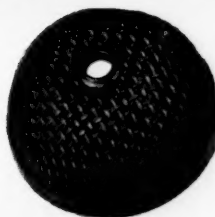
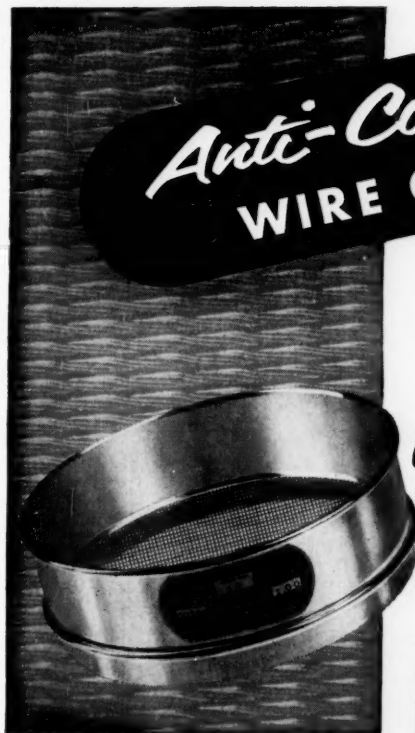
Linck tells us that he got the idea for the current article while

Anti-Corrosive WIRE CLOTH

- STAINLESS STEEL
- "NICHROME"
- "MONEL"
- PHOSPHOR BRONZE

for

- FILTER CLOTH
- SPECIAL PARTS
- STRAINERS
- SIEVES
- TRAPS
- SCREENS



Are you using wire cloth or wire cloth parts which must be corrosion resistant? Are the service conditions in your plant really tough? If you have a problem selecting the proper anti-corrosive alloy, Newark Wire Cloth may have the answer.

Available in all corrosion resistant metals, Newark Wire Cloth is accurately woven in a wide range of meshes, ranging from very coarse to extremely fine.

If you have a wire cloth problem involving corrosion, please tell us about it . . . we may have the answer.

NEWARK
for ACCURACY

A complete line of woven
wire cloth and wire cloth
parts in all malleable
metals.

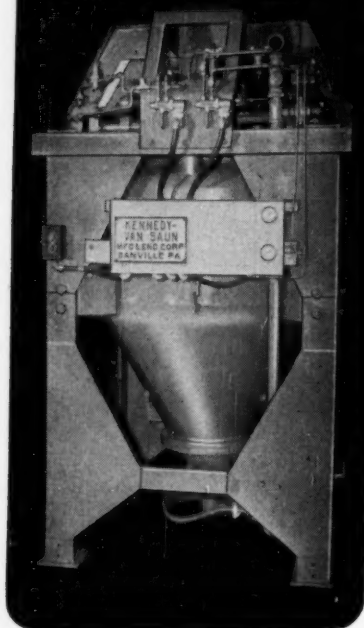
Send for Catalog E

Newark
Wire Cloth
COMPANY

351 VERONA AVENUE • NEWARK 4, NEW JERSEY

the KENNEDY PNEUMATIC TRANSPORT SYSTEM... for

Pulverulent and Granular Materials utilizes the unique and exclusive advantages of the KENNEDY PNEUMATIC TRANSPORT PUMP.



- ★ NO MOTORS
- ★ NO FEED SCREWS
- ★ NO MOVING PARTS while transporting material
- ★ BATCH CYCLE BY WEIGHT can be used to check inventory
- ★ HIGHER PRESSURES for greater efficiency
- ★ AIR used only when transporting material.

KENNEDY PNEUMATIC SYSTEMS

Write for literature

**KENNEDY-
VAN SAUN**
MANUFACTURING & ENGINEERING CORP.

2 Park Avenue, N. Y. 16, N. Y.
Factory—Danville, Pa.

AUTHORS . . .

indirectly involved in the experimental work done at Graham to develop a six-stage ejector.

Community affairs have always held an attraction for Linck. Besides being an active member of the Rotary Club, he has served on boards of several civic and charitable organizations.



Jack G. Lowenstein

CALCULATE ADEQUATE RUPTURE DISK SIZE. PAGE 157

Food Machinery & Chemical's Jack Lowenstein is a member of the central research and development team of the firm's chemical divisions.

It's a part of his team's job to research, assemble and put into usable form any information which will speed up equipment and process design.

When his team was assigned the job of digging up information on the design of explosion vents for several vessels, they found that practically no information was available—short of a few catalogs published by rupture disk manufacturers.

After the team assembled all required data, it whipped up a rather comprehensive report. This report, evolved into the current article—which presents explosion data in a novel, handy form as well as a straightforward and accepted means of calculating vent and rupture disk sizes.

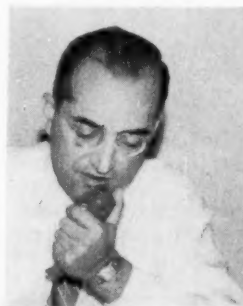
Jack Lowenstein joined Food Machinery & Chemical in 1956. Before that time, he chalked up a five-year stint with the Chemical Corps Engineering Command, in Edgewood, Md. There, he worked on detection and identification kits, automatic gas alarms, and protective gear.

Earlier in his career, he worked as an assistant production manager for General Gummed Products, Inc., in New York.

Lowenstein earned his chemical engineering degree from Pratt Institute in 1950. Just now, he's working towards a master's at the University of Maryland. While at school, he won a war veterans scholarship in 1948 from New York State. Around the same time, he was also awarded honorary membership in the American Electrochemical Society for electrochemical research.

This isn't the first time that Author Lowenstein's work has appeared in this magazine. He has turned out quite a number of "Plant Notebook" items over the years, as well. What's more, he has also authored about half a dozen articles—mostly on fluid flow.

Lowenstein is married, with two children. They live in Baltimore, Md. Non-professional interests include model railroading—an HO gauge layout (which he hasn't been able to touch since the kids are around). He's also an avid science fiction fan, which he reports has kept him from shock at the swift developments in the rocket and "sputnik" fields.



Carl Pacifico

HOW "DEAR BOSS" LETTERS SPAWN CREATIVITY. PAGE 179

American Alcolac's Carl Pacifico deplores the unrealistic approach of engineers to business problems, despairs that the objectives of our society are not the same as the fundamental requirements of the human organ-

ism, delights in his family and friends, and desires to introduce the principles of science to organize the many scraps of business facts into a body of knowledge similar to engineering.

He grew up in South Philadelphia where he learned "that hard work and self reliance are a satisfactory substitute for connections and proper tie."

Pacifico attended Drexel Institute of Technology on the co-operative basis, using his periods in industry to try some types of engineering jobs. He received his B.S. in chemical engineering in 1943, with honors.

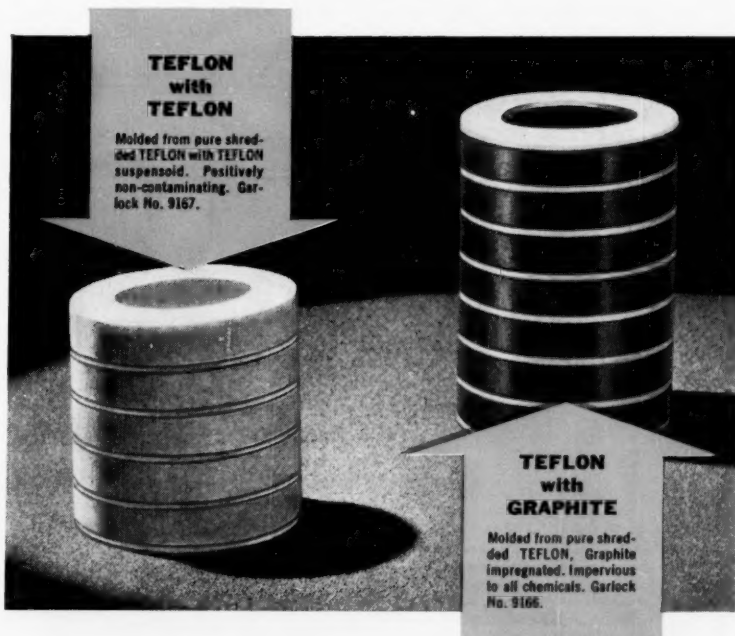
The next two years were spent in the Air Force as a radar officer. Key lesson learned here was that the routine organization and utilization of technical people, however necessary it may seem in wartime, results in low efficiency and a minimum of creative thinking. (*C'est la guerre!*)

His military stint was followed by a period of "floundering around" (a retrospective judgment) working on various jobs for Publicker Industries. The trend of jobs gradually moved from the technical to the commercial. Then, in 1949, he joined Wyandotte Chemicals in market development work. This gave him an opportunity to learn something about the chemical process industries and the people in it.

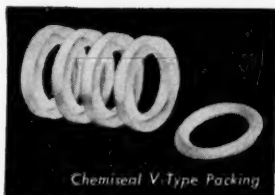
During this period, he decided that random reading was not a satisfactory means of accumulating knowledge. He laid out a five year program to educate himself thoroughly. To make sure that his reading cut deep, he wrote a book as he went along, summarizing the subject matter. So far, prospective publishers commend the ambitious manuscript but have serious doubts about its commercial future.

In 1954, Pacifico joined American Alcolac where he is now vice president. This has provided him an opportunity to become acquainted with all phases of a reasonably small company which makes technical products. And, perhaps more important, it has also provided him with a superior (i. e. the company president) who's willing and even eager to apply creative ideas in business decisions.

CHEMISEAL® PUMP PACKINGS standard for corrosion service



good for all chemicals



FOR VALVES

Solid TEFLON Ring packings are available in Chemical V-type, diagonal, triangular, conical and Garlock Chevront ring designs—providing necessary seal at low gland pressure and reducing torque required to operate the valve.

© U.S.G. Trademark
*du Pont Trademark
†Garlock Trademark

Chemiseal TEFLON* Pump packings offer remarkably trouble-free service, and useful life many times that of other type packings.

Impervious to all chemicals, excepting only molten alkali metals and fluorine at elevated temperatures, these packings are giving highly satisfactory performance sealing against such difficult and hazardous liquids as sulphuric, chromic, nitric and hydrofluoric acids; chlorine, bromine, sulphur chloride, sulphur oxychloride, hydrogen fluoride and concentrated hydrogen peroxide.

Extremely effective for rotating and reciprocating shafts, Chemiseal TEFLON pump packings provide a low friction, 2-way seal that not only prevents axial seepage, but also seals against shaft and stuffing box as well. Supplied in sets to meet specific requirements.

For prompt service, contact one of The Garlock Packing Company's 30 sales offices and warehouses in the U.S. and Canada, or write for Bulletin AD-155.

United States Gasket Company
Camden 1, New Jersey

United States Gasket

Plastics Division of

GARLOCK



New heating problem? Old production headache? R: Far-Infrared



*Call the Chromalox man for the **ANSWERS***

At his fingertips, your Chromalox Representative has the answer to production delays, irregular product quality and other common problems caused by complex, outmoded heat sources. Chromalox Electric Far-Infrared radiation can be simply and precisely controlled over largest work areas, and is absorbed uniformly by practically all colors—even optically transparent materials.

With this fast, uniformly distributed heat, generated right at the job site, there is no need for stand-by heat or leaking lines. No smoke, fumes or flames. No glare. It's cooler and cleaner for your workers, too. Chromalox

Far-Infrared elements are self-cleaning. Maintenance costs are minimum, as the all-metal heaters are practically indestructible—have no moving parts.

Get the best answers to all your heating problems. For assistance on new installations, or on improving an existing system, call or write your Chromalox Sales Engineering Representative. Standard heaters, to fit most jobs, are ready for immediate shipment from the world's largest stock. What's more, your Chromalox Representative offers factory design-engineering service for special applications. He has the electrical answer that's fast, clean, safe, accurate and economical.

C-2122A

CHROMALOX Electric Heat

Edwin L. Wiegand Company

7514 Thomas Boulevard, Pittsburgh 8, Pennsylvania • CHURCHILL 2-6400



Call Chromalox

for the man with the
ELECTRICAL ANSWERS
to your heating problems

ATLANTA 9, GA.
Applebee-Church, Inc.
1389 Peachtree St., N.E.
Trinity 5-7244

BALA-CYNWYD, PA.
J. V. Calhoun Co.
349 Montgomery Ave.
MOhawk 4-6113

BALTIMORE 18, MD.
Paul V. Renoff Co.
333 E. 25th St.
HOpkins 7-3280

BLOOMFIELD, N. J.
R. L. Faber & Associates, Inc.
1246 Broad Street
EDison 8-6900

BOSTON 11, MASS.
Leo C. Pelkus and Co., Inc.
683 Atlantic Ave.
Liberty 2-1941

BUFFALO 2, N. Y.
Niagara Electric Sales Co.
505 Delaware Avenue
SUmmer 4000

CHARLOTTE 2, N. C.
Ranson, Wallace & Co.
116½ East Fourth St.
EDison 4-4244
FRanklin 5-1044

CHATTANOOGA 1, TENN.
H. R. Miles and Associates
P. O. Box 172
Phone 5-3862

CHICAGO 6, ILL.
Fred I. Tourtelot Co.
407 S. Dearborn Street
HArrison 7-5507

CINCINNATI 8, OHIO
The Smyser Company
1046 Delta Avenue
TRinity 1-0605

CLEARWATER, FLA.
J. J. Galleher
617 Cleveland Street
P. O. Box 1376
Phone 3-7706

CLEVELAND 13, OHIO
Anderson-Bolds, Inc.
2012 W. 25th Street
PRospect 1-7112

DALLAS 25, TEXAS
L. R. Ward Company
3009-11 Canton Street
Riverside 1-6279

DAVENPORT, IOWA
Volco Company
215 Kahl Bldg.
Phone: 3-2144

DENVER 2, COLO.
E. & M. Equipment Co.
2415 15th Street
GLendale 5-3651
GEnesee 3-0821

DES MOINES 14, IOWA
Midwest Equip. Co. of Iowa
842 Fifth Avenue
CHerry 3-1203

DETROIT 38, MICH.
Carman Adams, Inc.
15760 James Couzens Hwy.
UNiversity 3-9100

HOUSTON 3, TEXAS
L. R. Ward Company
3605 Polk Avenue
CApital 5-0356

INDIANAPOLIS 4, IND.
Couchman-Conant, Inc.
627-631 Architects &
Builders Bldg.
MElrose 5-5313

KANSAS CITY 6, MO.
Fraser D. Moore Co.
106 E. 14th Street
VICTor 2-3306

LOS ANGELES 15, CALIF.
Montgomery Brothers
1053 South Olive Street
RICHmond 7-9401

MIDDLETOWN, CONN.
Dittman and Greer, Inc.
33 Pleasant Street
DIamond 6-9606

MILWAUKEE 3, WIS.
Gordon Hatch Co., Inc.
531 W. Wisconsin Avenue
BRoadway 1-3021

MINNEAPOLIS 4, MINN.
Volco Company
831 South Sixth Street
FEderal 6-3373

NASHVILLE 4, TENN.
H. R. Miles and Associates
2500-B Franklin Road
CYpress 2-7016

NEW YORK CITY, N. Y.
See "Bloomfield, N. J."
WORTH 4-2990

OMAHA 2, NEB.
Midwest Equipment Co.
of Omaha
1614 Izard Street
ATlantic 7600

PHILADELPHIA, PA.
See "Bala-Cynwyd, Pa."
GRenwood 3-4477

PITTSBURGH 6, PA.
Woessner-McKnight Co.
1310 Highland Bldg.
HIS S. Highland Avenue
EMerson 1-2900

PORTLAND 3, ORE.
Montgomery Brothers
1632 N.W. Johnson Street
CApital 3-4197

RICHMOND 28, VA.
(Branch, Charlotte)
Phone 88-8758

ROCHESTER 4, N. Y.
Niagara Electric Sales Co.
133 Clinton Avenue, South
HAMilton 6-2070

ST. LOUIS 1, MO.
C. B. Fall Company
317 North 11th Street
CHestnut 1-2433

SAN FRANCISCO 3, CALIF.
Montgomery Brothers
1122 Howard Street
UNderhill 1-3527

SEATTLE 4, WASH.
Montgomery Brothers
911 Western Avenue
SEneca 3270

SYRACUSE 8, N. Y.
R. P. Smith Co., Inc.
2507 James Street
HOWard 3-2748

WICHITA 2, KANS.
Fraser D. Moore Co.
Room 211 Derby Building
352 N. Broadway
AMHerst 2-5647



PEOPLE...

LETTERS: PRO & CON

C. H. CHILTON

That big red "26" you see here—and on this issue's cover—will mean a lot to you in 1958. How?

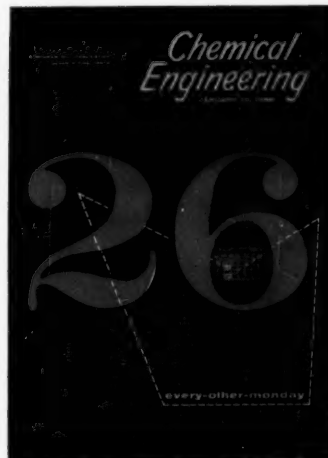
• It means 26 streamlined issues that'll be faster to read, easier to take home in your briefcase.

• It means more technical news—and more timely news—in one place to cut down the total reading matter you've had to go through to keep in touch with today's fast-moving technology.

• It means more editorial pages for that broadened, exclusive coverage of process advances and engineering techniques you've been asking for.

• It means CE can now give you more—yet save you time—through faster, better, broader coverage than ever before.

• Be sure to let us know what you think of the job we're doing; this will help us serve you—as well as all chemical engineers—even better in the future. Simply address your letter or postcard to Editor, *Chemical Engineering*, 330 W. 42nd St., New York 36, N. Y.



Con: Dust Collector Claims Sir:

In reading over the article, "Wet Scrubber Fits Into Duct," in your August issue (pp. 192-4), I find many points open to question.

You make the statement that the Microdyne collector is "the first commercial dust collector to embody all the fundamental principles of the Greenberg-Smith impinger." If this is true, where is the high-velocity jet, the 180° reversal of flow and the large expansion chamber of the Greenberg-Smith unit?

You say that the collector "matches the ductwork for size." Yet the rating of the 8-in.-dia. unit is only 500 cfm. This flow rate in an 8-in. duct gives a velocity of only 1,500 fpm., which would allow heavy dust to settle out. According to usual practice, 500 cfm. would be accommodated

by a 5½-in. duct in which the velocity would be about 3,000 fpm.

Inasmuch as the cross-section of an 8-in. duct is 2.56 times that of a 5-in. duct, the manufacturers claim seems to be of little value.

Further, the article states that the design of the screen assures that there is no straight path through the unit and, therefore, "each piece of dust will contact a wet surface." I wish that making dust particles contact wet surfaces were as easy as this, but it never is.

The article compares the pressure drop through the Microdyne (5-8 in.) with that through a venturi scrubber (30-50 in.). This is not a fair comparison, as the venturi scrubber is entirely different in principle. I have figures which show pressure drops through the Hydro-Filter—a



NEW

NEPTUNE STAINLESS STEEL LIQUID METER

**ONLY TWO MOVING PARTS
IN THE LIQUID**

Now you can achieve fine-instrument accuracy in the processing of corrosive liquids . . . in batching, blending, transfer, cost accounting, etc. . . . with this new Neptune Stainless Steel Meter.

Also important in many processes, this Neptune meter ends many problems caused by contamination of liquids being measured.

Based on the reliable Neptune positive displacement principal, its accuracy is completely protected from the effects of corrosion or corrosive wear. There are only two moving elements in contact with the liquid. The gear-train is mounted outside the casing, isolated from the liquid.

Available with Direct Reading, Print-O-Meter or Auto-Switch Registers. Size 1½", capacity 100 gpm. with most liquids.

Ask for Bulletin 94/10 P

NEPTUNE METER COMPANY

19 West 50th Street, New York 20, N. Y.

BRANCHES IN: ATLANTA • BOSTON • CHICAGO • DALLAS • DENVER
NEW YORK • NO. KANSAS CITY, MO. • LOS ANGELES • LOUISVILLE
PORTLAND, ORE. • SAN FRANCISCO-BAY AREA (MILLBRAE)
IN CANADA: NEPTUNE METERS LTD., TORONTO 14, ONT.

neptune

PRO & CON . . .

unit more nearly like the Microdyne—to be only 3-7 in.

I'm afraid that there is more salesmanship than engineering in your story.

H. LESLIE BULLOCK
Engineering Consultant
New York, N. Y.

► While we don't question Mr. Bullock's engineering analysis of the manufacturer's claims for Microdyne, we take exception to his closing comment.

The stories in our Process Equipment department have one primary function—to inform our readers of individual new developments in equipment. The source of our information is almost always the manufacturer of the equipment. It's only natural for the manufacturer to claim certain advantages for his product. We are careful to identify the claims by such phrases as these used in the Microdyne story: "Efficiency reported to be greater"; "to back up such a claim, officials say"; "Microdyne engineers are showing some cost comparisons;" etc.

The type of penetrating analysis which Mr. Bullock's letter suggests is the function of our feature engineering articles and reports. In the same issue as the new scrubber story is a comprehensive report in which various methods of odor control are reviewed and compared and another article on various ways in which mechanical energy can be applied to diffusional separations.—Ed.

Pro: Chemical Metallurgy

Sir:

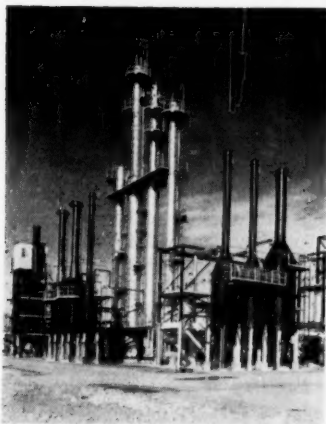
I was very pleased to see the announcement (Aug. 1957, p. 3) that the biennial Award for Chemical Engineering Achievement will this year go to the various companies who have successfully applied chemical engineering in production of the "atomic-age" metals.

I am greatly interested in this phase of chemical engineering, and I am convinced that the application of techniques developed by chemical engineers for the petroleum and other chemical processing industries has been vital to successful production of these metals. In addition, the technical developments necessary for commercial production of the rarer metals are now being successfully applied to the commoner metals which have heretofore been produced chiefly

by conventional metallurgical processes, utilizing a minimum of chemical engineering.

It appears to me that the developments which are being honored by the award represent just the beginning. The broad application of chemical engineering principles to the winning of the metals of the future may well revolutionize the entire metallurgical field.

J. A. PATTERSON
Engineering Consultant
Pittsburgh, Pa.



Universal, Not Union

Sir:

Your Process Flowsheet for November, "Solid Gilsonite Feeds 'Petroleum Refinery'" (pp. 222-5), contains a statement which involves two errors: "Raw naphtha overhead then feeds to a two-stage reforming operation—Union Oil of Calif.'s Unifining followed by Union Oil Products' Platforming."

Unifining is a catalytic hydrogen treating process; no reforming occurs. The operation described, therefore, is not two-stage reforming. The two processes are quite separate, and either can operate without the other. It is common from the standpoint of economics to utilize the net hydrogen product from Platforming as a source of hydrogen for Unifining (as in this installation), but it is by no means mandatory.

Platforming is licensed by Universal Oil Products Co., the correct full name for the commonly used initials, UOP. Uni-

We've come a long way too

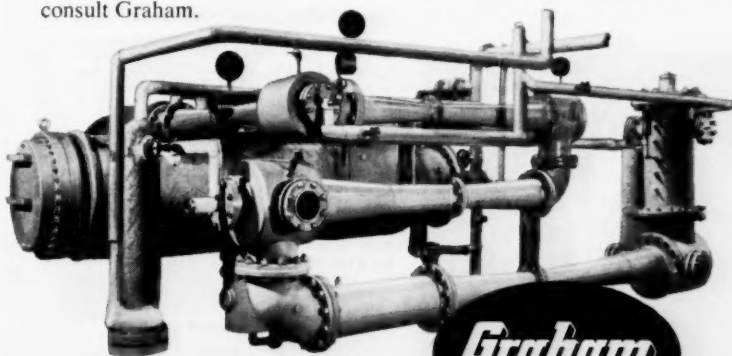


vacuum
Graham experience—like this old timer—dates 'way back

Today, through constant research, our "know-how" has reached a "high" where industry realizes that the solution of any vacuum problem is better handled by Graham engineering, and in special cases is augmented by the complete resources we have available for further exploration.

If vacuum is your problem, we offer you the proper type of steam or gas propelled ejector ranging from the smallest and simplest single stage unit up to and including the more complicated 7 stage type shown below, capable of sustaining 1 micron absolute pressure.

Our entire line of steam jet ejectors involves a completely new series of designs that have not only produced improved efficiencies but prices and deliveries that are more competitive than heretofore. Don't miss a bet. If you have a vacuum problem it will pay you to consult Graham.



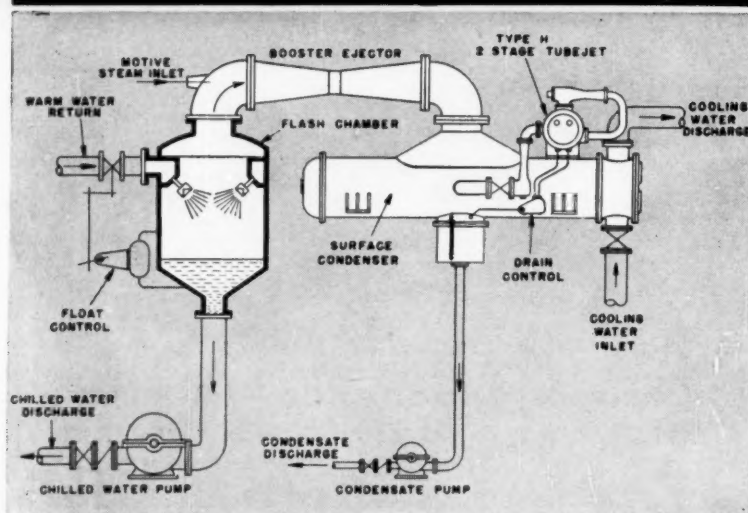
Write for Graham Bulletin No. 70-A.

GRAHAM MANUFACTURING CO., INC.

415 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Sales in principal cities and Canada

Save money 2 ways



Above schematic diagram shows Wheeler Jet Vacuum Refrigeration Unit with surface condenser. Unit is easily adapted to low level jet or barometric jet condensers.

when you CHILL PROCESS WATER

C. H. Wheeler Steam Jet Vacuum Refrigeration operates at exceptionally low cost because it uses low pressure exhaust steam—steam that would otherwise be wasted in your processing plant.

Maintenance costs are unusually low, too, because there are no moving parts, except for those in the chilled water pump. No noise or vibration, either, with Wheeler Steam Vacuum Refrigeration.

It's an ideal refrigeration system for any application requiring chilled water temperatures of from 35° to 65°F. Wheeler Jet Vacuum Refrigeration has proved itself time after time in the chemical, food and process industries.

See your representative or write direct to C. H. Wheeler of Philadelphia for complete information.

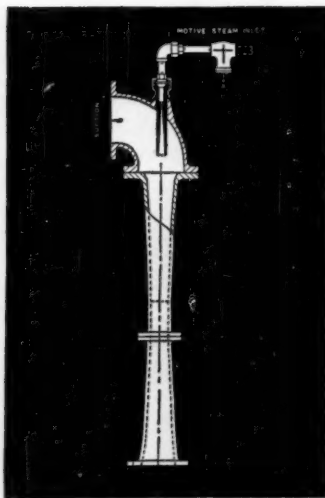
Wheeler "Tubejet" Booster Ejectors withdraw vapors at high vacuum, and discharge them to a lower vacuum in the condenser. Air and non-condensable vapors are removed from the condenser by a two-stage Wheeler "Tubejet".

Process Equipment Division

C. H. Wheeler Mfg. Co.

19TH & LEHIGH AVENUE
Philadelphia 32, Pennsylvania

Vacuum Equipment • Centrifugal, Axial and
Mixed Flow Pumps • Steam Condensers •
Marine Auxiliary Machinery • Nuclear Products



PRO & CON . . .

fining is licensed both by Universal and Union Oil Co. of Calif.

D. P. THORNTON, JR.
Universal Oil Products Co.
Des Plaines, Ill.

Con: Poor Color Register

Sir:

The bright, multicolor diagrams used in your magazine are a fine feature, easy on the eyes and a welcome aid to the reader.

Nevertheless, more often than not the colors don't superimpose as planned. In most cases this is unimportant, but in such things as design charts it is more than annoying, for it results in inaccurate charts. One such example is the displacement of the vertical axis of the chart on page 253 of your August 1957 issue, in which the error is about 5%.

How about rectifying this situation? One solution is to use only one color for all lines of a design chart.

OCTAVE LEVENSPIEL
Bucknell University
Lewisburg, Pa.

► *Registry of color is a real problem in commercial printing. To ameliorate the effects of poor register, we provide single-color tick marks along the ordinates of most design charts. The reader can then see that values read from the curves may have to be corrected.*
—Ed.

Pro: Odor Control

Sir:

Permit us to compliment you and Mr. Von Bergen on the factual, comprehensive and interesting report, "Industrial Odor Control," appearing in your August issue (pp. 239-250).

We think you have done a particularly good job on the discussion of the catalytic combustion process. We have these two comments:

• We believe that incorrect credit was assigned to Fig. 1. We first employed this design in 1951, and the illustration first appeared in a 1952 paper by Harold F. Borger of Hilton-Davis Chemical Co., published in *American Paint Journal*.

• Our friend Amos Turk, whom you used as a reference,

overlooked the energy available when suggesting a lower practical range of concentration for catalytic combustion. This is also clear from your heat-content table when referring, for instance, to hexane. One of our self-recuperative systems can usually be operated on a fully self-sustaining basis, without external heat, when the temperature rise through the catalyst bed exceeds about 225 F.

R. J. RUFF
Catalytic Combustion Corp.
Detroit, Mich.

► For a specific odor control problem and solution, see Dec. 1957, pp. 164-6.—Ed.

Pro: Fermentation Glycerine Sir:

We refer to your recent news item (Nov. 1957, p. 140), on the acquisition by Scientific Design Co. of licensing rights to the fermentation glycerine process developed by Imperial Chemical Industries.

We do not agree that "for U.S. conditions, fermentation glycerine must overcome a tough economic barrier, requiring a much more favorable spread than now exists between cost of molasses and cost of propylene and chlorine, chief raw materials for making synthetic glycerine."

Our data indicate that fermentation glycerine may be produced at competitive cost with the propylene synthesis process at a price of \$25-30/ton for blackstrap molasses, when propylene and chlorine are priced at \$50/ton and \$60/ton, respectively.

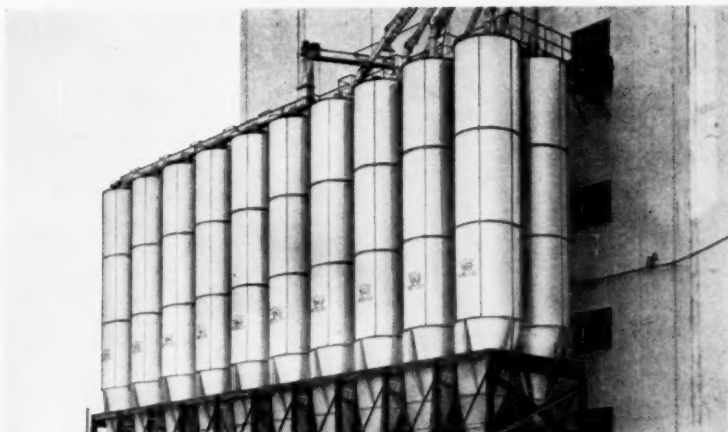
According to recent trade reports, a major U. S. alcohol manufacturer has purchased 160 million gal. of blackstrap molasses from Cuba's 1957 and 1958 crops at a price of about \$17/ton, fob. Cuba. An assured long-term supply of molasses in this price range yields attractive cost economics for the fermentation glycerine process.

A. R. SMITH
Scientific Design Co.
New York, N. Y.

► Regardless of the price of molasses, we hope to publish a more detailed story on the fermentation glycerine process in an early issue.—Ed.

DAY

BULK STORAGE NEWS



A battery of 20 DAY vertical bulk storage tanks serving packaging line as well as truck and rail car loading operation. Each tank section holds approximately a carload of ingredients.

DAY BULK STORAGE TANKS

No other method stores bulk materials at lower cost

SAVINGS is one of the big advantages of DAY bulk storage and material handling equipment. Typical reports from DAY bulk tank owners tell of savings from 25¢ to 35¢ per hundred pounds of material handled. With DAY tanks, you save container or bag costs, you save labor, you save storage space and you save "invisible loss" because there's no spillage or breakage. DAY tanks improve plant efficiency and keep costs down.



For the most complete line of economical bulk tanks in vertical and horizontal styles, turn to DAY, now. Increase your plant's operating efficiency, lower material handling costs, improve sanitation and housekeeping with DAY bulk tanks. Free bulletin tells how to handle bulk material at lower cost with DAY units. Write to DAY for Bulletin 574.

The DAY Company

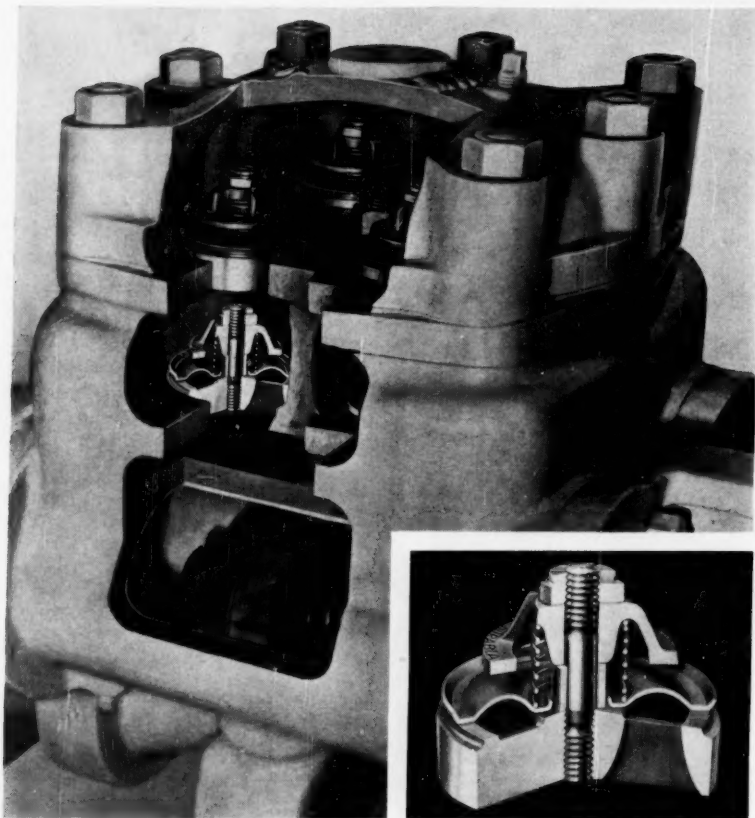
SOLD in UNITED STATES by
The DAY SALES Company
856 Third Ave. N.E., Minneapolis 13, Minn.



MADE and SOLD in CANADA by
The DAY Company of Canada Limited
P.O. Box 70N, Fort William, Ontario

Representatives in Principal Cities

EQUIPMENT ONLY OR A COMPLETE SYSTEM



The valve for reciprocating pumps ... old or new

Because they offer a happy combination of dependability, efficiency and extra life, DURABLA Valves are a credit to any reciprocating pump. Mechanically and metallurgically speaking, they will operate freely under temperature-pressure extremes, with highly corrosive fluids and in any position.

In a DURABLA Valve Unit, only "point contact" is made by the valve member on the sleeve, so it can't bind or hang-up. Due to its unique arched design, neither will it warp. The new V-7* taper-locked stud can be screwed down tight into the seat without any possibility of galling or breakage. And a self-locking nut and "drop-on" guard assure quick and easy inspection of working parts — without stud or seat removal.

Standard equipment on many new pumps, DURABLA Valve Units are also used throughout the world to re-valve older pumps. They come in fifteen sizes, designed to meet over 300 variations in installation requirements.

Write for new booklet CE18.

DURABLA MANUFACTURING COMPANY
114 Liberty Street, New York 6, New York

DURABLA®

*Patent applied for

DM-34

PEOPLE . . .

NAMES IN



Charles C. Van Soye

Charles C. ("Chuck") Van Soye has joined *Chemical Engineering's* staff as an editorial assistant.

Chuck is a graduate in chemical engineering from Cornell University (1954). At Cornell, he received an engineering scholarship and won the 1954 regional AIChE student paper award. After graduation, he was 1st Lieutenant in the Army for 2 years, serving as a research and development coordinator with the Ballistic Research Laboratories at Aberdeen Proving Grounds, Md., and in the Marshall Islands.

Before joining *Chemical Engineering*, Chuck was a chemical engineer in the technical service division at Sun Oil Co.'s Marcus Hook refinery. His work involved process studies, operation trouble-shooting, comparison of equipment performance and maintenance studies for lube oil manufacture.

Philip H. Lawrence has been named plant manager of the Niagara Falls, N. Y., plant of B. F. Goodrich Chemical Co. Henry H. Striby has been appointed supervising engineer of the company's Louisville, Ky., plant.

W. Robb Nisbet has been transferred to the Lion Oil Co. Division of Monsanto Chemical Co. and is now manufacturing superintendent in charge of ethylene facilities at Texas City, Tex.

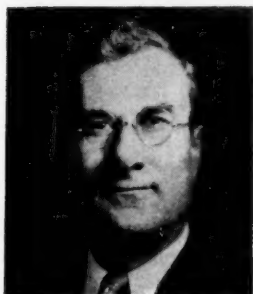
THE NEWS

M. A. GIBBONS

Sidney J. Baum has been elected vice president in charge of plastics development and production for Foster Grant Co., Leominster, Mass.

Orlin J. Gibbs was promoted to technical foreman, profit analysis unit, costs and economics department, at Gulf Oil Corp., Port Arthur, Tex.

Charles K. French is now manager of the product development department at the new Anaheim, Calif., plant of Flexible Tubing Corp. He will have complete charge of the company's large new laboratory.



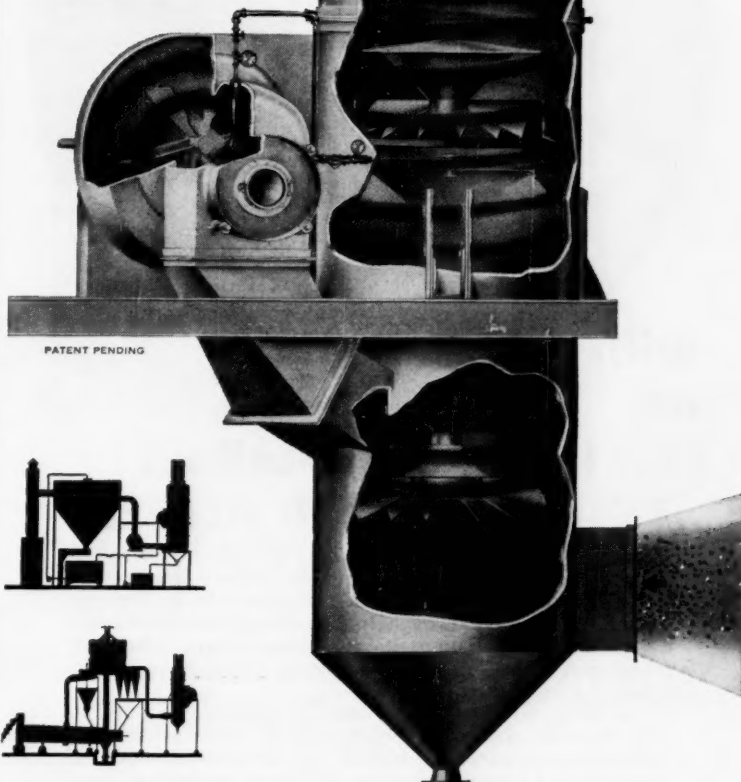
Warren K. Lewis

The father of modern chemical engineering, Warren K. Lewis, was 1957 recipient of the American Petroleum Institute's Gold Medal for Distinguished Achievement—a citation presented to an outstanding American who has contributed substantially to the advancement of mankind through the petroleum industry.

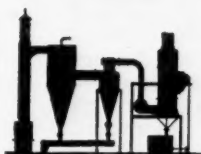
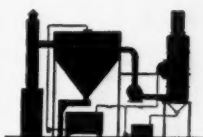
An international leader in petroleum research and a teacher for almost half a century, Dr. Lewis is emeritus professor of chemical engineering at Massachusetts Institute of Technology. He taught at MIT from 1905 until 1948 as assistant professor, professor, head of the chemical engineering department.

Dr. Lewis is credited with many contributions to the oil in-

The Practical Solution to... WET DUST CONTROL



PATENT PENDING



The Ducon Centrifugal Wash Collector, Type UW-4, is a basic air scrubber with extensive applications for the wet principle collection of problem dusts and recovery fines. For maximum collection efficiency of extremely fine dusts under the most varied conditions... such as in high dust loading and for abrasive dusts... this unit has proved unexcelled in many types of industrial processes. Unitized construction, precision shop-fitted parts and integrated fan assembly provide simple, rapid installation into the normal processing system.

Write today for descriptive Bulletin No. W-7456



the name in DUST CONTROL
Ducon

THE Ducon COMPANY, INC.

147 EAST SECOND STREET • MINNEAPOLIS, MINN. 55401

Sales Representatives in Principal Cities

In Canada: The Ducon Company of Canada, Ltd., P.O. Box 20 • Montreal, Quebec

Designers and Manufacturers of Dust Collectors, Washers, Cyclones, and Valves

CYCLONES • CENTRIFUGAL WASH COLLECTORS • THROTTLE VALVES • CHECK VALVES

Control Your

PROCESS HEAT

to

$\pm 2^{\circ}$

FAHRENHEIT

with
an

International-LaMont THERMAL LIQUID HEATER*

Now, you can enjoy the advantages of safe, low pressure process heat to 750°F.—plus pinpoint temperature control with an International-LaMont Thermal Liquid Heater. Unique, forced recirculation through tubular circuits eliminates the danger of fluid decomposition. Process temperatures are maintained within $\pm 2^{\circ}\text{F.}$, with instant response to changing load demands.

Operating pressures range from atmospheric to only 30 psig. Obvious savings over high pressure steam systems for comparable temperatures include: (1) Drastic reduction of operating and supervisory costs; (2) No expensive high pressure equipment and controls; (3) Lower installation and maintenance costs.

You will save money while increasing production efficiency with an International-LaMont Thermal Liquid Heater—proved best for dependable, economical generation of high temperature process heat for every industrial requirement. Write for Bulletin TLH.

International- World Leader in Boiler Progress

*Especially designed for use with Aroclor, Dowtherm, Mobiltherm and other thermal liquids.



BOILER BUILDERS SINCE 1886

**THE INTERNATIONAL
BOILER WORKS CO.**

860 Spruce St.

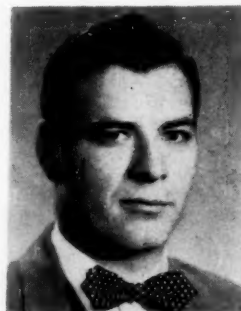
East Stroudsburg, Pa.

Steel Firebox Heating & Power Boilers
Low & High Pressure Water Tube
Package Boilers • International-
LaMont Forced Recirculation Gen-
erators • ASME Code Pressure
Vessels & Welded Products.

NAMES . . .

dustry, among them perfection of efficient methods of fraction in refining; of solvent recovery systems; of vacuum distillation of lubricating oils and of the widely used refining process, fluid catalytic cracking.

In addition to the API award, Dr. Lewis has also received the Priestly Medal of the American Chemical Society; Perkin Medal of the Society of the Chemical Industry; Gold Medal of the American Institute of Chemists; first American Chemical Society Award in Industrial and Engineering Chemistry.



Nat Kessler

A. E. Staley Mfg. Co. has announced the appointment of Nat Kessler as its chief chemical engineer.

Kessler joined Staley after completing work for his M. S. in chemical engineering in 1944. He was a chemical engineer at the company's Decatur, Ill., plant until 1951, when he was named technical supervisor of the company's Painesville, Ohio, plant. He returned to Decatur in 1953 as senior chemical engineer.

Since early 1957, Kessler served as acting head of Staley's chemical engineering section. In his new position he succeeds George N. Cornell, who was recently named director of a new operations research department.

Hugh S. Ferguson, former executive vice president of W. R. Grace & Co., has been elected to the Board of Directors of National Research Corp.

R. Carter W. Jones has been named assistant manager of the eastern region of

Du Pont's petroleum chemicals division. Jones was formerly sales service manager for the division and before that had managed its sales promotion section.



O. D. Myrick, Jr.

Organization of a development planning department with O. D. Myrick, Jr. as director, has been announced by Davison Chemical Co. Division of W. R. Grace & Co. Purpose of the new group is to assist in the expansion efforts of Davison's product divisions.

Myrick, who has been with Davison since 1942, has served in several capacities in the company's research and development department, most recently as manager of development.

J. B. Charlton and R. N. Coker have been named supervising engineers and will head two newly formed groups in the process and planning department of Chemstrand Corp.'s engineering division. Charlton heads the economic evaluation group in the planning section while Coker heads the fibers group in the process section.

James C. Geddes, Jr. has joined the research and development department of Ethyl Corp. at Baton Rouge, La.

William N. Wright has been appointed acting associate director of the patent division of Esso Research and Engineering Co. John D. Wells has been named senior staff engineer in the company's engineering coordination unit.

Positive Proof...

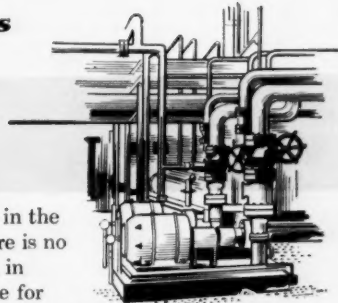
The Type 9 Shaft Seal Solves Those Tough Liquid Handling Problems

Actual Field Reports



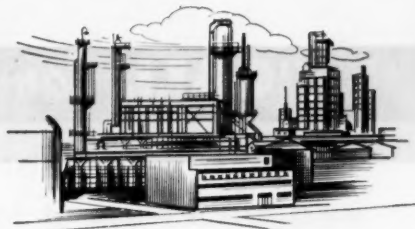
from an Arkansas Refining Plant

When it comes to avoiding trouble in the handling of naphtha at 420°F., there is no substitute for positive sealing. And in cases like this there is no substitute for "John Crane's" Type 9 Seal. Many months of completely satisfactory operation offers convincing proof.



from a Louisiana Refinery

It takes a "lot of shaft seal" to handle a highly corrosive mixture such as an emulsion of sulphuric acid and butane. This stuff plays real havoc with metals due to its corrosive action. Despite this, Type 9 Seals on twenty seven pumps are pumping month after month in continuous service. At this same location, other Type 9's are effectively handling "fresh" sulphuric acid at the high suction pressure of 400 psi.



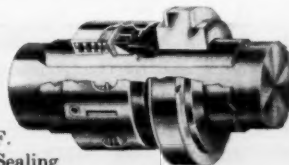
In cases like these... and in those confronting you... the surest answer is the "John Crane" Type 9 Seal.

CONDENSED SPECIFICATIONS

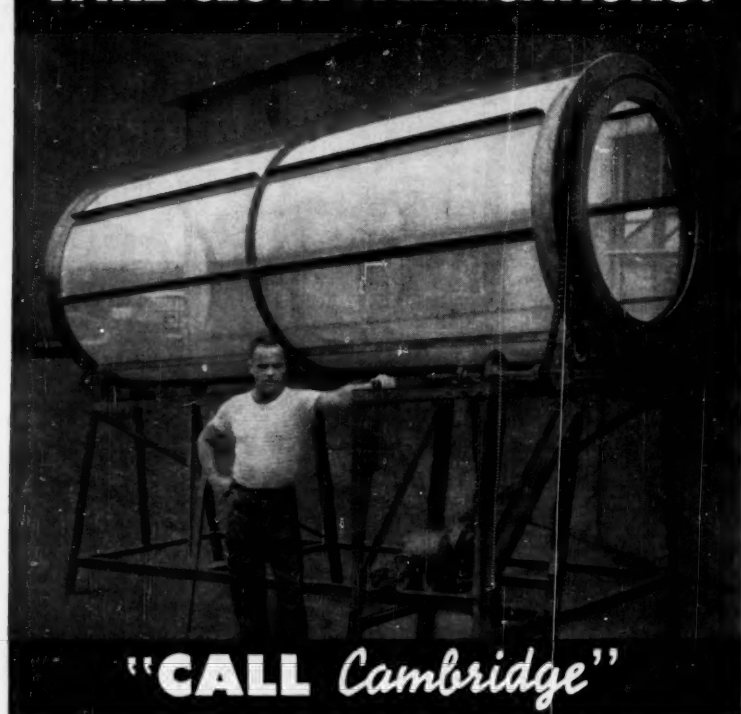
Recommended services: all industrial chemicals, corrosives, liquids or gases. Temperatures: -120°F. to +500°F. Pressures: up to 750 psi. Construction: Sealing members of chemically inert DuPont Teflon, metallurgy best suited to service requirements.

Send us your problems. Request Bulletin S-205-2.

Crane Packing Company, 6451 Oakton Street, Morton Grove, Illinois, (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.



"WIRE CLOTH FABRICATIONS?"



**"You tell us what you need,
and we'll have it for you fast—
whatever the size or shape"**

Roland's right, too. Here at Cambridge he's part of a team that has produced everything from thimble-sized strainers to king-sized de-watering screens, often well ahead of schedule. Whatever your requirements, you're assured of quality workmanship and prompt service when you call Cambridge. And, we'll work from your specifications or draw up prints for your approval.

TO MEET YOUR BULK WIRE CLOTH NEEDS, we have a wide variety of specifications from the finest to the coarsest mesh—in any metal or alloy—in the most frequently used specifications ready for immediate shipment. Individual loom operation and careful inspection just before shipment assures accurate mesh count and uniform mesh size.

Let us quote on your next order for wire cloth. Call your Cambridge Field Engineer listed in the telephone book under "Wire Cloth". Or write direct for **FREE 94-PAGE CATALOG** and stock list giving the full range of wire cloth available. Describes fabrication facilities and gives useful metallurgical data.



The Cambridge Wire Cloth Company



DEPARTMENT G,
CAMBRIDGE 1,
MARYLAND

OFFICES IN PRINCIPAL INDUSTRIAL CITIES

NAMES



J. R. Stein

Dow Chemical Co. has announced the appointment of J. R. Stein as general manager of its Louisiana Division facilities now under construction on a 1,600-acre tract on the west bank of the Mississippi River at Plaquemine, about 10 miles south of Baton Rouge.

Stein started his Dow career in 1937, following his graduation from the University of Michigan. He was with organic research and production engineering activities until 1940 when he was assigned to the Texas Division. In 1943 he was appointed an assistant general manager and was responsible for production control, construction and maintenance control, economic evaluation and purchasing.

Since the spring of 1956, when construction facilities began, Stein has been project manager of the Louisiana Division.

J. T. Faubion, formerly manager of production coordination, has been promoted to manager of planning and distribution of Dow Chemical Co.'s Texas Division. George E. Hardy has been appointed product manager of Dow's new pharmaceuticals section, which takes the place of the former fine chemicals section.

E. M. Dannenberg is the director of carbon black research for Godfrey L. Cabot, Boston, Mass. Raymond P. Rossman has been named director of Cabot's newly formed carbon black technical department. And Randolph Antonsen is director of the company's newly formed new products

research and development department.

John D. Czarnecki is the new manager of research-plastics for Bradley Container Corp. and Pittsburgh Plastics Co.

R. K. Turner has been appointed president of Bakelite Co. Division of Union Carbide Corp. He succeeds George C. Miller, who has been appointed president of Union Carbide Realty Co.

M. Clark Wakefield has joined Borden Co.'s chemical division as Midwest district sales manager of the Plyco-Monomer department.



George P. Brandt

New production manager of Callery Chemical Co.'s \$4 million plant at Lawrence, Kan., is George P. Brandt.

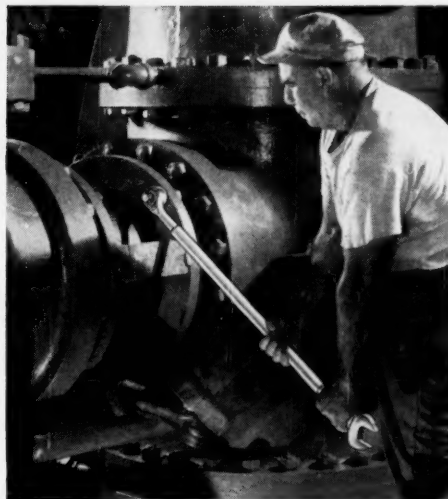
Brandt was a production and control supervisor at the Oak Ridge, Tenn., atomic energy project from 1944-1947. He joined Callery in 1953 as a section head in research and development and has not only helped select the Kansas site for the new plant but also worked on design and procurement.

Lincoln T. Work, consulting chemical engineer, is the new president of the Association of Consulting Chemists and Chemical Engineers.

Joshua S. Bowen, Jr. has joined the chemical engineering group of Atlantic Research Corp., Alexandria, Va. Bowen will conduct research on pyrometallurgical problems,

TOOLS WITH MUSCLE

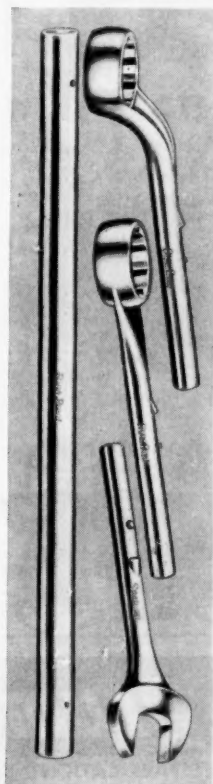
to service
industrial
equipment



Snap-on Heavy-Duty
Blue-Point

BOXOCKET® Open End WRENCHES

5 sizes — 15",
▼ 18", 24", 30", 36"



22 sizes —
1 1/8" to 3 1/8"

21 sizes —
1 5/8" to 3 1/2"

9 sizes —
7/8" to 1 1/2"

Here are the husky, powerful wrenches repairmen need on many industrial repair jobs. They're safe, dependable, the kind mechanics can really "lay into." And they're available in quickly changeable combinations of Open End Wrenches and straight or offset Boxocket® models.

The tightest nuts and bolts turn easily under powerful leverage. Their trim build and long reach get these tools into location quickly and easily. When free swing is restricted, double hexagon broaching allows a short turning arc. Extension handles lock securely, can't be separated accidentally — a safety factor you and your men will appreciate.

Yes sir, it's tools like Snap-on heavy-duty wrenches that help cut downtime — put machinery back into action. Snap-on provides specialized hand tool service through 54 branch offices. Call your branch or write us for catalog.



SNAP-ON TOOLS
CORPORATION
8106-A 28th Avenue • Kenosha, Wisconsin

Stainless Steel Fabrication by KIRK & BLUM

With 50 years of experience in the field, KIRK & BLUM offers economical fabrication to the most exacting specifications.

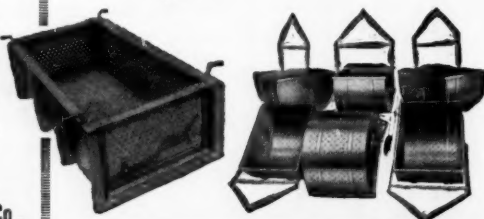
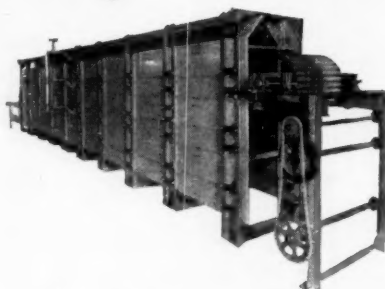
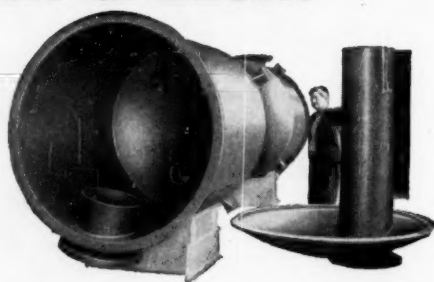
Stainless fabrication is quite different from conventional steel working. KIRK & BLUM engineers and workers have the special knowledge and techniques to do an outstanding job.

In all-important welding, for example, you are assured intelligent control of these factors which contribute to a first quality fabrication job:

- selection of the best process . . . metallic arc or inert gas arc welding, seam or spot welding.
- prevention of distortion and warpage.
- restriction or removal of discoloration.
- prevention or removal of carbide precipitation.

Whatever your requirements, KIRK & BLUM facilities are at your service. For prompt quotation, send prints and details to:

The Kirk & Blum Mfg. Co.,
3208 Forrer St.,
Cincinnati 9, Ohio



KIRK & BLUM
STAINLESS STEEL FABRICATION

NAMES . . .

and investigate propellant systems.

Bernard I. Spinrad is now director of the reactor engineering division at Argonne National Laboratory, Lemont, Ill.

H. S. M. Burns, president of Shell Oil Co., was elected chairman of the Board of Directors of the American Petroleum Institute.



Joseph C. Elgin

The 1957 William H. Walker Award, considered one of the highest honors of the chemical engineering profession, was presented to Joseph C. Elgin, dean of Princeton University's engineering school.

The Award was bestowed on Dr. Elgin for his fine contributions to chemical engineering literature, especially for his papers in the field of liquid-liquid extraction.

Since receiving his degrees of bachelor and master of science from the University of Virginia, and a doctorate from Princeton in 1929, Dean Elgin has had a distinguished academic, industrial and governmental career. He has published numerous papers and articles on solvent extraction; gas absorption; rubber reclaiming; removal of sulfur from petroleum; mechanics of fluidized systems; photochemistry and heterogeneous catalysis.

Dr. Elgin began his Princeton teaching career in 1929, became dean of the engineering school in 1954 and was named chairman of the Board of Trustees last year.

Joseph C. Abeles has been elected a director of Haile Mines, N. Y. He is also a director, vice president and treasurer of Kaweck Chemical Co., Boyertown, Pa., and a director of Hexagon Laboratories, N. Y. and Talco Engineering Co., Hamden, Conn.

L. Daniel Fessenden has joined Pfaudler Co., Rochester, N. Y., as a member of the engineering department. He reports to the director of central engineering on consultant work aimed at providing technical direction for increased sales on agitation and mixing equipment.

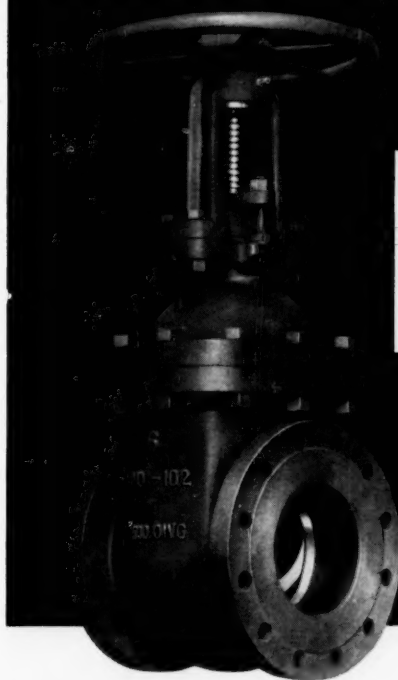
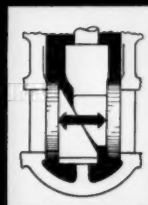
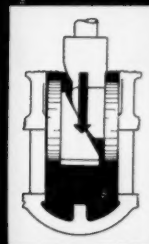
OBITUARIES

William H. Pinckard, retired chairman of the California Texas Oil Co., Ltd., in New York, died in Palo Alto, Calif., on October 20. He was 63 years old.

Charles H. Snow, dean emeritus of the College of Engineering at New York University, died on October 28 at the age of 94. Dr. Snow was dean of NYU's engineering school from 1897 to 1930. He was a founder of the American Society of Mining and Metallurgical Engineers and a fellow of the American Association for the Advancement of Science.

J. E. Underwood, universally known as "Jude" throughout the chemical industry and profession, died on November 25 in Princeton, N. J., at the age of 68. Underwood's long and active career began with pioneering research on radium and radioactivity for the U. S. Bureau of Mines during and immediately after World War I. During World War II he returned to government service to join the Office of Production Research and Development of the War Production Board. From 1944 until his retirement a few years ago, Underwood was director of research for Diamond Alkali Co., Painesville, Ohio.

RIGHT: Operating diagram of Darling gate principle. Fully revolving discs and complete release of wedging pressure during gate travel assure uniform wear distribution. Closure wedging automatically provides seating compensation for pressure-tight seating every time.



How Darling gate valves can help MAINTAIN PROCESS SCHEDULES

THE unique Darling gate valve principle, diagrammed above, provides today's best assurance of prolonged good behavior and avoidance of leaks and process interruptions! It's a natural where the most reliable operation is vital month in, month out.

You'll find this feature in Darling's economical hard-rubber-lined iron body valves for corrosion services up to 150 pounds. Same goes for other Darling gate valves in sizes, types and metals of various alloys for all kinds of normal and unusual services. Write for Catalog No. 57.

ENGINEERING SERVICE: Darling offers unusual facilities for the development and manufacture of special valves for out-of-the-ordinary requirements. This special service is available to you at all times, without obligation.

DARLING VALVE & MANUFACTURING CO.
Williamsport 3, Pa.

Manufactured in Canada by
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

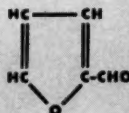


CURIOSITY IS THE KEY TO PROGRESS



They're curious about the workers on the scaffold supported by nylon rope... an end product using furfural as a chemical intermediate

YOU CAN PROFIT FROM CURIOSITY
ABOUT **QO FURFURAL**®



Here are a few of the ways QO furfural is now being used:

- **SELECTIVE SOLVENT** for separating saturated from unsaturated compounds in petroleum lube oil, gas oil, and diesel fuel.
- **RESIN FORMER** in the manufacture of thermosetting molding powders with optimum flow-cure properties.
- **DISPERSANT** in the manufacture of resinoid-bonded grinding wheels. Solvent for coating materials.
- **CHEMICAL INTERMEDIATE** in the manufacture of hexamethylenediamine, used to make nylon; starting point for compounds containing the furan ring.

BE CURIOUS ABOUT FURFURAL • SEND FOR QO BULLETIN 204

The Quaker Oats Company

CHEMICALS DEPARTMENT



335X The Merchandise Mart, **Chicago 54, Illinois**
Room 535X, 120 Wall Street, **New York 5, New York**
Room 435X, 48 S.E. Hawthorne Blvd., **Portland 14, Oregon**
In the United Kingdom: Imperial Chemical Industries, Ltd., Billingham, England
In Europe: Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France; A/S "Ota," Copenhagen, S. Denmark
In Australia: Swift & Company, Ltd., Sydney
In Japan: F. Kanematsu & Company, Ltd., Tokyo

PEOPLE ...

FIRMS IN



Monsanto Chemical Co. has relocated its general offices. New address: Lindbergh & Olive St. Road, St. Louis 24, Mo.

Helipot Corp., division of Beckman Instruments, has a new mailing address: P. O. Box 458, Newport Beach, Calif.

Carboline Co., manufacturer of corrosion-resistant protective coatings and linings, has moved its general office and laboratory to 32 Hanley Industrial Center, St. Louis 17, Mo.

Permutit Co. has relocated its main office at 50 West 44th St., New York 36, N. Y.



American-Marietta Co. has purchased Niagara Concrete Pipe Ltd. of St. Catherine, Ont. Acquisition extends American-Marietta's precast concrete operations into Canada's most active construction area.

American Can Co. is planning to merge with Marathon Corp., a major producer of pulp, paper and paperboard, subject to stockholder approval.

Haveg Industries has acquired Lithgow Chemical Co. of California, manufacturer of chemical-resistant plastic coatings, cements, impregnations and laminated linings.

Crucible Steel Co. is now full owner of Rem-Cru Titanium, Inc., having acquired the

THE NEWS

J. B. BACON

half-interest owned by Remington Arms Co.

Air Products Inc. has acquired Kemsco, Inc. of Torrance, Calif. Kemsco will continue to manufacture its liquefied gas pump and will still engage in low-temperature research.



NEW
FACILITIES

Celanese Corp. of America has opened a new polyolefin pilot research laboratory in Summit, N. J., to investigate applications for made-to-order fibers of predesigned molecules.

Esso Standard Oil's new Cologne, Germany, refinery is now slated to swing on stream in November 1958. Capacity of the \$83.3-million installation will be 70,000 bbl./day with further expansion already being planned.

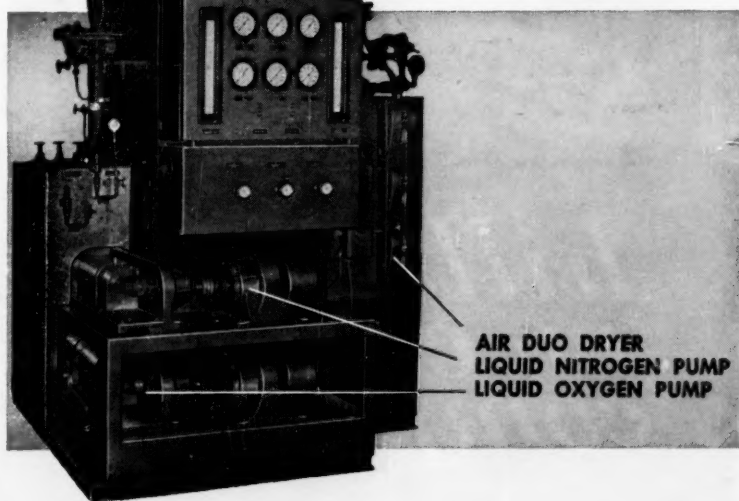
Helipot Corp., division of Beckman Instruments, has opened a new \$3-million plant in Newport Beach, Calif., for production of its helical potentiometer, used widely in instrumentation and in guided missiles.

California Oil Co. has awarded a contract to H. K. Ferguson Co. for construction of a 10,000-bbl./day catalytic reformer at its Perth Amboy, N. J., refinery. Completion is scheduled for first of 1959.

Venezuelan Government has cleared 750 acres of forest at Moron, Venezuela, and is building a \$335-million petrochemical complex. Plastics, textiles, fertilizers, explosives and synthetic rubber will be

The very latest in Package Type Plants Producing

Simultaneously




AIR DUO DRYER
LIQUID NITROGEN PUMP
LIQUID OXYGEN PUMP

With the introduction of our latest, improved design Package Type Generating Plants, production of high purity Oxygen and Nitrogen simultaneously *increases* production 60% over the production of Oxygen alone, *plus* a corresponding reduction in the *cost* of manufacture. Due to its compact design, a minimum of floor space is required and streamlined panel assembly insures instant visibility of all control gauges. Stock sizes from 1500 to 10,000 cu. ft. per hour. Larger and smaller sizes available. 99.99% Argon available on large size plants.

We invite your inquiry.

INDEPENDENT ENGINEERING COMPANY, Inc.

CONSULTING  DESIGNING
RESEARCH

Manufacturers of
CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE - OXYGEN - NITROGEN - ARGON

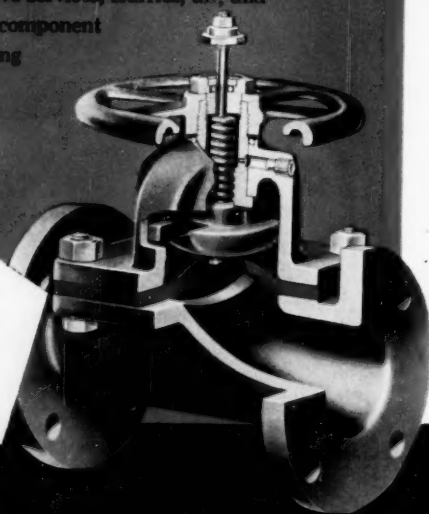
O'FALLON 7, ILLINOIS

stop costly leaks with positive control **DIAPHRAGM VALVES**

Where there's a valve leak, there's a profit leak. Hills-McCanna Diaphragm Valves give positive control on throttle or cut-off—for liquids, gas, corrosive services, slurries, air, and water. This packless, tri-component valve with exclusive sealing bead diaphragm assures leaktight closures.

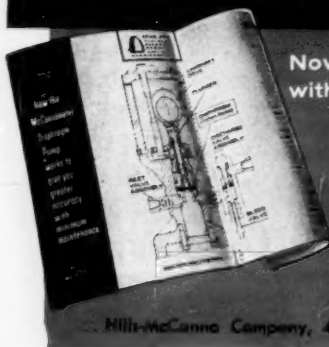
Write today for Valve Booklet #104

EXCLUSIVE
SEALING BEAD
DIAPHRAGM



Hills- McCanna company

THE PEOPLE WHO KNOW AND CONTROL FLOW



Now ... Precision Fluid Metering
with **NEW DIAPHRAGM PUMP**

New McCannameter Diaphragm Pump delivers new high pressure range, new broad capacity range, new wide operating speed range, cuts maintenance costs. Write for "A New Concept in Precision Metering and Proportioning of Fluids." Ask for Booklet #301.

*Pat. appl. for

Hills-McCanna Company, 4568 W. Touhy Ave., Chicago 30, Ill.

FIRMS . . .

made from crude petroleum. Completion date is early 1960.

Hooker Electrochemical Co. is building a \$3.5-million research center at Grand Island, N. Y. Housing 200 personnel, facility will be completed by 1960.

Amoco Chemicals Corp. has a new 25,000-sq. ft. plant in Seymour, Ind., that is producing starter cartridges for jet aircraft engines.

Monsanto Chemical Co. is adding 15,000 sq. ft. to facilities of its Organic Chemicals Div. including expanded laboratory and greenhouse space.

Chemical Construction Corp. has started work on a new development center near New Brunswick, N. J. Building will have complete facilities for pilot testing and process development.

Harvey Aluminum's new 54,000-ton/yr. aluminum plant at The Dalles, Ore., is nearing completion; a 120,000-kw. transmission line has recently been installed.

Babcock & Wilcox's Tubular Products Div., Koppel, Pa., is expanding its stainless steel facilities with the addition of a new electric-arc furnace costing around \$13 million.

Westinghouse Electric Corp. has installed complete facilities at its Fairmount, W. Va., plant for production of quartz tubing.

National Aluminate Corp. has completed a third phase of its expansion program with completion of a \$1.5-million addition to administrative and laboratory facilities.

Semet-Solvay Petrochemical Div. of Allied Chemical & Dye Corp. has installed new manufacturing facilities for atomized A-C polyethylene at the Buffalo, N. Y., plant. This addition assures an adequate supply of this polyethylene powder which has been in short supply.

Firestone Tire & Rubber Co. has purchased a synthetic rubber pilot plant and laboratory in Akron, Ohio, owned by the government since 1944.

National Petro-Chemicals Corp. will build a new 75-million-lb./yr. polyethylene plant slated to be completed in 1958. Plant will be engineered and built by M. W. Kellogg at Houston, Tex.

Calumet Nitrogen Products Co. has started production at its new 300-tons/day anhydrous ammonia plant in Hammond, Ind. Hydrogen for plant comes from nearby oil refining operations.

Arizona Portland Cement Co. will construct a \$12-million cement plant at Ash Fork, Ariz., to be in operation by spring of 1959. The 2 million-bbl./yr. plant will supply primarily the growing needs of northern Arizona.

Hercules Powder Co. will double urea capacity at its Hercules, Calif., plant. New unit will use ammonia and carbon dioxide as raw materials; expected to be finished by late 1958.

Jefferson Chemical Co. has contracted with Scientific Design Co. for the building of a 60-million-lb./yr. ethylene oxide plant at Port Neches, Texas. Plant is slated for operation in 1958.

Stauffer Chemical Co. will enlarge its Richmond, Calif., plant to produce 50,000 tons/yr. of pelletized single superphosphate. New \$350,000 plant will use a unique process developed by Stauffer. Operation is slated for March 1958.

Ansul Chemical Co. is adding 3,000 sq. ft. to its manufacturing facilities for disodium methyl arsonate. Scheduled to be in operation by late fall, addition will cost \$40,000.

Witco Chemical Co. is building a 13,000-sq. ft. plant near Toronto, Ont., for production of

DOW CORNING SILICONE DEFOAMERS



have proved their efficiency and versatility in countless applications. For example:

1 OUNCE KILLS FOAM IN . . .

625,000 lb
sodium bromide crystallization solution

250,000 lb
molasses, vat dye solution, trioxide pickling solution, tall oil

125,000 lb
phenolformaldehyde, urea formaldehyde, asphalt, starch sizing

62,500 lb
soft drinks, 70% caustic liquor, black liquor, sulfuric acid pickling bath

Just a few drops of a Dow Corning SILICONE DEFOAMER can prevent mountains of foam . . . enabling you to utilize full productive capacity and put your processing into high gear. What's more, when you control foam, you eliminate the mess and waste of boilovers. Whatever your foaming problem, a Dow Corning SILICONE DEFOAMER will help solve it at amazingly low cost.

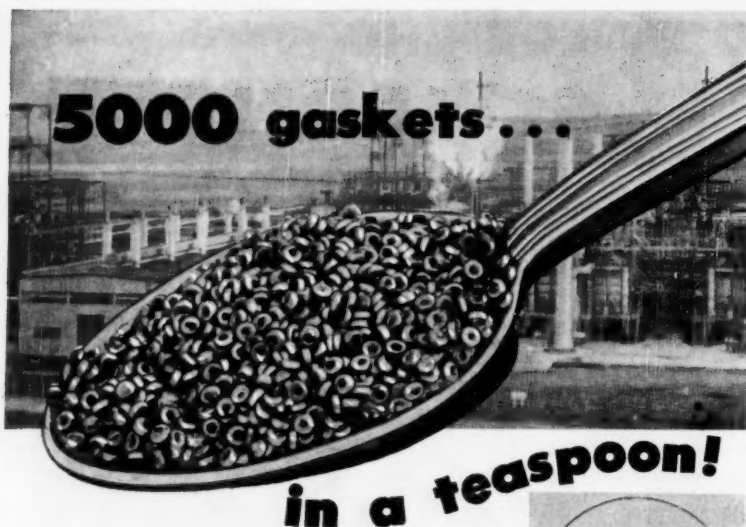
FREE SAMPLE and INFORMATION—

To receive a generous trial sample of a Dow Corning Silicone Defoamer, return coupon below or write on your letterhead. No obligation, of course.



Dow Corning CORPORATION
MIDLAND, MICHIGAN

NAME _____		261A	<i>My foamer is</i> Oil system _____ Aqueous system _____ Food products _____ Other _____
TITLE _____			
COMPANY _____			
CITY _____	ZONE _____	STATE _____	
<div style="border: 1px solid black; padding: 5px; text-align: center;"> </div>			



Metallo may hold the answer to your gasket problems in a teaspoon, in a gigantic gasket as big as transportation facilities will allow—or in any one of the many, many standard gaskets available for IMMEDIATE SHIPMENT. In any event, Metallo has the answer, because Metallo has been serving the Chemical Industry for 38 years with gaskets in every size, shape and design conceivable—as well as with standard gaskets fabricated in strict accordance with the customers' specifications and templates.

From vacuum to 30,000 psi, and from -320 f. to +2300 f. Metallo can supply gaskets for your specific purposes.

Metallo stock gaskets are made to seal readily and endure the severest attacks of chemical deterioration your process equipment can handle. They are designed to withstand extreme pressure conditions—wide temperature ranges—accommodate expansion and contraction, corrosive and erosive contaminants, absorb shocks, vibrations, misalignments—yet, conform to strictest performance specifications.

IMMEDIATE DELIVERY FROM STOCK

Custom Gasket Orders
Given Prompt Attention

Consulting Engineering And
Design Service Available
At No Cost



WRITE TO
DEPT. CE-1 FOR
NEW 2-COLOR
20 PAGE
CATALOG.



Style 1
Plain corrugated metal .019 thick with corrugation $\frac{1}{4}$ " pitch in standard or large sizes. $\frac{1}{16}$ " to $\frac{3}{8}$ " pitch can be specified.
Recommended for low and medium pressure steam, tar, heavy oils and chemicals.



Style 2
Corrugated .019 metal with best grade hard asbestos cord cemented in corrugation.
Widely used on steam, air, gas and tar lines.



Style 3
Single jacketed with .008 to .019 metal jacket enclosing one face and both edges. Filler can be asbestos mill-board, sheet packing rubber, teflon or as specified.
Uses including air, ammonia, chemical, oil and steam lines.



Style 4
Double jacketed; with .008 to .019 metal jacket enclosing both faces and edges. Filler as specified.
For high temperatures, pressures and severe working conditions.

22 Standard Style Gaskets Available

PRIMARY SOURCE FOR RASCHIG & LESSIG RINGS

metallo gasket co.

15 BETHANY ST. • NEW BRUNSWICK, N. J. • K1 lmer 5-7223



FIRMS . . .

metallic stearates—used as waterproofing agents, gelling agents, lubricants and paint flattening agents. Early 1958 is production date.

Capitol Products Corp., aluminum fabricator, is building a 70,000-sq.-ft. plant near Sherman, Tex. Fabrication facility will serve a ten-state area.

Standard Oil Co. (Ind.) will have a new 140,000-bbl./day crude still operating at its Whiting, Ind., refinery in 1959. New unit will permit abandoning several smaller units in use for many years.

Allied Chemical & Dye's General Chemical Div. is completing a major expansion of its sulfur hexafluoride plant at Baton Rouge, La. Addition will enable it to meet increased demands of electronic industries.

Borden Co. has a new butadiene styrene plant on stream at Illiopolis, Ill. Plant, replacing outmoded facilities, triples capacity of manufacturing operations.

Sharples Corp.'s English subsidiary, Sharples Centrifuges Ltd., has moved into a new plant at Camberley, Eng. Plant provides increased manufacturing research and test facilities.

Link-Belt Co. doubled manufacturing capacity in Los Angeles, Calif., area when it moved into a new 90,000-sq.-ft. plant. Company also plans a new \$5-million plant in Indianapolis, Ind., area, to be in full production by 1959.

Electro Metallurgical Co. has completed new production facilities at Alloy, W. Va., for manufacture of Mantemp exothermic ferromanganese; expands capacity six-fold.

Solvay Process Div. of Allied Chemical & Dye Corp. has doubled capacity at its Brunswick, Ga., mercury-cell chlorine-caustic soda plant, produces liquid caustic (50%

NaOH) in both regular and rayon grades.

Firestone Tire & Rubber Co. is already mapping plans for expansion of its Orange, Tex., butadiene plant. Completed seven months ago with a capacity of 40,000 tons/yr., plant supplies raw material for company's synthetic rubber plants.

Tube Turns Div. of National Cylinder Gas Co. is increasing its manufacturing area 40% by converting buildings on property adjacent to its Louisville, Ky., plant. Program will cost around \$400,000.

Formica Corp., subsidiary of American Cyanamid, by spring of 1958 will have added 100,000 sq. ft. floor space at its Evansdale, Ohio, plastic laminates plant.

Swastik Oil Mills Ltd. is operating India's first synthetic detergent plant. Foster D. Snell Inc. engineered the plant in Bombay which supplies industrial and household detergents.

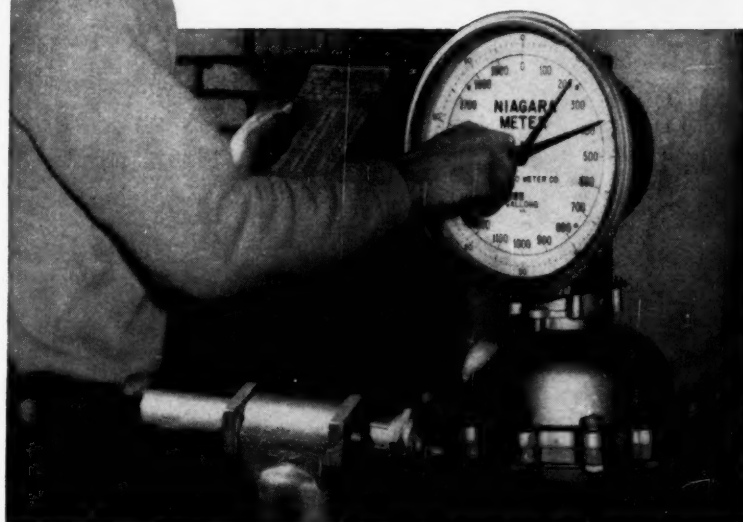
Monsanto Chemical Co.'s Springfield, Mass., Lustrex high-impact styrene installation will be doubled in capacity. Completion is slated for May 1958.

Continental Oil Co. has completed its atomic radiation laboratory in Ponca City, Okla., will use nuclear radiation in experiments aimed at improving petroleum products and processes.

Macco Corp. of Los Angeles, Calif., has started construction on a 100-ton/day ammonia plant at Lathrop, Calif. Plant will cost \$4.8 million and should be completed by Oct. 1958.

Socony Mobil Oil Co.'s first alkylation unit at its Buffalo, N. Y., refinery is now on stream. Unit produces 2,400 bbl./day aviation-grade alkylate from a mixed propylene-butylene-isobutane feed stock.

MEASURE LIQUIDS ACCURATELY



UP TO 1000 GPM WITH NIAGARA Displacement Meters

Measurement of liquids in any process is only as dependable as the accuracy of the measuring equipment. Niagara Meters measure volumetrically. Each nutating cycle of the piston displaces a fixed volume which remains constant for any specified liquid and temperature range. Niagara Meters are individually tested and calibrated to close tolerances at all rates of flow within their capacity.

Accurate measurement prevents waste and loss. Liquid formulas can be processed with accuracy insuring greater uniformity of product.

Learn all the facts . . . Mail the coupon for complete information.

**BUFFALO
METER CO.**

2891 Main Street
BUFFALO 14, NEW YORK

Please send me information on the complete line of Niagara Meters.

Liquid.....

Flow g.p.m..... Temp.....°F

Name.....

Company.....

Address.....

***FIRST LINE**

Extended-Surface

HEAT EXCHANGERS

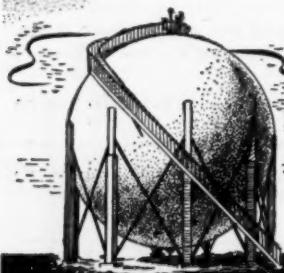


**ASK THE
AEROFIN MAN**

Specify Aerofin and you specify high efficiency, long service life and low maintenance and service costs.

Take advantage of Aerofin's unequalled experience, production facilities, and materials-testing and design research—of Aerofin's complete engineering service at the plant and in the field.

** Aerofin makes extended heat surface exclusively — not as a by-product, not as a side-line.*



*Throughout the
Chemical Industry—*

**Aerofin units do the job
Better, Faster, Cheaper**

AEROFIN CORPORATION

101 Greenway Ave.
Syracuse 1, N. Y.

*Aerofin is sold only by manufacturers of
fan-system apparatus. List on request.*

FIRMS . . .

**NEW
COMPANIES**

Larkin Associates has been organized to offer complete research and development service to the aircraft-missile, plastics and chemical industries.

CycloBlower Co., York, Pa. has been incorporated for engineering, manufacture and sale of blower-compressors and vacuum pumps.

Catalysts & Chemicals, Inc. will manufacture specialty catalysts for the chemical, petroleum and food industries from a million-dollar plant in Louisville, Ky.

Index Industrial Corp. has been set up to import and distribute heavy machine tools. Among lines handled is Wotan precision boring mill.

Nuclear Chemical Co. has been organized in Chicago, Ill., for manufacture of organic compounds tagged with radioactive substances.

Silicon Crystals Inc. in Wilmington, Del., has been established to produce silicon and other semiconductor metals and manufacture semiconductor devices.

Analytic Systems Co. has been formed as a division of Research Instrument Corp. for manufacture and sale of instruments for process stream analysis.

Air Products (Gt. Britain) Ltd. has been organized in England by Air Products Inc. of Allentown, Pa., and Butterly Co. of London. Firm will design, manufacture and install oxygen plants for European market.

AFN Inc. has been formed to participate in government's high-energy fuel program. Company is owned one-third each by American Potash,

Food Machinery & Chemical Corp. and National Distillers & Chemical Corp.



Pfaunder Co. has obtained a limited license to manufacture and sell a low-vacuum version of the Arthur F. Smith Co. high-vacuum molecular still.

Southwestern Engineering Co. is now designing and producing a complete new line of vacuum equipment including surface condensers and steam-jet ejectors.

General Mills has formed a Nuclear Equipment department which will specialize in remote-control handling equipment for use in radiation laboratories.

Kimberly-Clark Corp. has formed a chemical division. First product is a clay additive for ceramic and brick that relieves stress, prevents efflorescence and aids molding.



Telco, Inc., 4030 Superior Ave., Cleveland, Ohio, is now the exclusive dealer for Denver pumps in the Cleveland area.

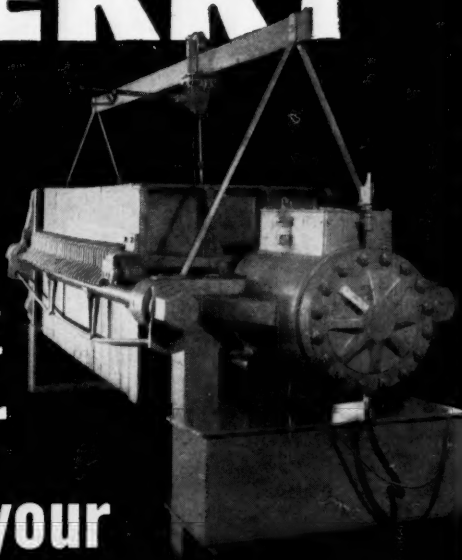
Berkshire Chemicals, New York, has taken over all sales activities of Vitro Manufacturing Co., a leading producer of ceramic colors.

American Potash & Chemical Corp. has been named national distributor for Pennsalt Chemicals Corp.'s Isotron line of refrigerant chemicals.

SPERRY

is the
low cost
answer
to all your

FILTRATION PROBLEMS



Consider all the money-saving aspects of a Sperry Filter Press. These include low initial cost . . . nominal installation . . . minimum maintenance . . . low depreciation . . . and an economy of operation that extends through many years of trouble-free performance.

However complex your filtration problems may be, these economies are basic to the solution.

You can avail your plant to the economies of a Sperry Filter Press, custom-engineered to meet your particular requirements for flow rate, cake build-up, washing, extraction, thickening, etc. Variations are provided, offering center, side or corner feed; open or closed delivery; simple or thorough washing; high or low temperature control. Plates may be had in aluminum, wood, iron, bronze, stainless steel, lead, rubber, nickel or any other special materials to meet your requirements. Any filter media can be used . . . cloth, synthetics, wire screen . . . paper. Labor-saving plate shifting devices and semi-automatic closing attachments are adaptable for any model . . . to increase production, minimize operation hazards and reduce wear and tear.

FOR A LOW-COST ANSWER TO YOUR FILTRATION PROBLEMS, SEE THIS SPERRY CATALOG . . .

an up-to-date fully illustrated reference manual of erection, operating, design and construction data and specifications. Mail coupon for your free copy today.

**D. R. SPERRY & CO.,
BATAVIA, ILLINOIS**

Sales Representatives

George S. Tarbox 808 Nepperhan Ave.
Yonkers, N. Y.

B. M. Pilhashy 833 Merchants Ex. Bldg.,
San Francisco, Cal.

Allredge & McCabe 847 E. 17th Ave.
Denver, Colorado

Texas Chemical Eng. Co.
4101 San Jacinto, Houston, Texas

**D. R. SPERRY & COMPANY
Batavia, Illinois**

- ☐ Send Free Sperry Catalog
☐ Have your Representative Contact us

Name _____

Company _____

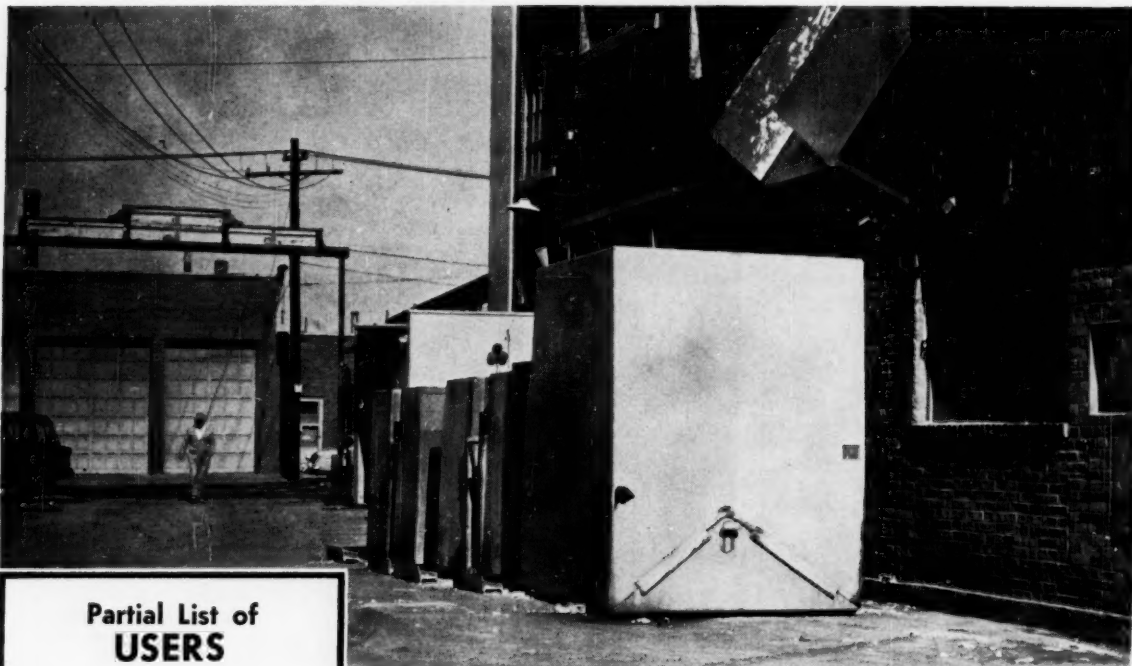
Address _____

City _____ State _____

CE



How "Containerization" Cuts Waste Disposal Costs In the Chemical Industry



Partial List of USERS

Allied Chemical & Dye Corp.
American Viscose Corp.
Celanese Corp. of America
Columbia Sou. Chemical Corp.
Dow Chemical Co.
E. I. Du Pont
Eli Lilly Co.
International Min. & Chem. Corp.
Koppers Company, Inc.
Merck & Co., Inc.
Monsanto Chemical Co.
National Aniline Div.
Nat. Petro Chemical Corp.
Pennsylvania Ind. Chem. Corp.
Rohm & Haas Co.
Tenn. Products & Chem. Corp.
Texas Eastman Company
Wallerstein Co.
Whitmoyer Laboratories, Inc.
Wyandotte Chemical Co.

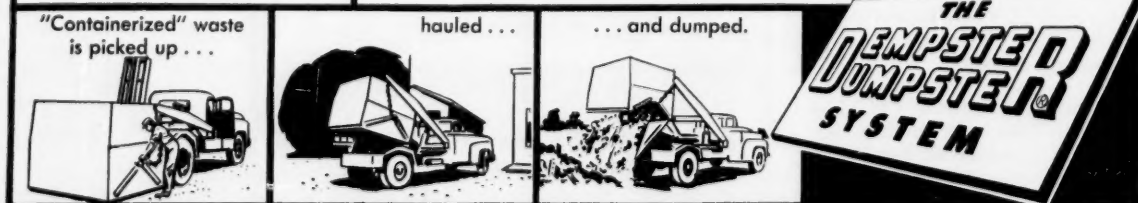
One-Man Dempster-Dumpster System Handles Waste Disposal For Entire Plant

Economical disposal of chemical-plant waste and improved "housekeeping" are the rewards of "Containerization." Clean, big-capacity Dempster-Dumpster Containers placed at inside and outside points of accumulation provide enclosed, fire-proof, scatter-proof storage for waste. One man, driving a truck-mounted Dempster-Dumpster, picks up, hauls, empties and returns each Container. The savings are obvious . . . improvement in plant cleanliness is astonishing! You may purchase your own system, or the Dempster-Dumpster Contract Hauler in your area will place Containers in your plant and empty them for a nominal fee.

WRITE TODAY

for your free copy of: "How to Cut Waste Disposal Costs" or, write for the name of the Dempster-Dumpster Contract Hauler in your area.

DEMPSTER BROTHERS, Knoxville 17, Tenn., Dept. CE-1



News

about HYPALON®

Cover of HYPALON
doubles life of elevator
belt exposed to 302° F.

Engineers at a large chemical plant faced a problem of finding an elevator belting material that would resist high temperatures. The belt had to lift hot salt 27 feet from a rotary drying kiln to a loading platform. Heat caused ordinary rubber belts to become brittle, crack and rupture at points where the Monel buckets were attached.

A specially designed belt with a cover of HYPALON synthetic rubber did the trick. It lasted 6 months (the best rubber belts lasted only 3 months) driven 188 feet a minute, hauling hot materials. HYPALON gave this service despite the fact that the belt was totally enclosed and operated 80 hours a week.



Elevator belt has cover of HYPALON. Outlasted previous belts 2 to 1 handling hot salt.

The resistance of HYPALON to heat (250° F.-350° F.) is only one of its many useful properties. It offers outstanding resistance to ozone and strong oxidizing agents; resists abrasion, flex cracking, weather. It can be compounded in a wide range of stable colors. Mail coupon for details on how products made of HYPALON can lower operating costs for you.

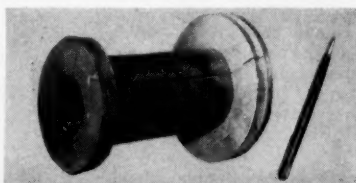
HYPALON is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.).

Neoprene connectors save \$1000 a year on hydrochloric acid pumps

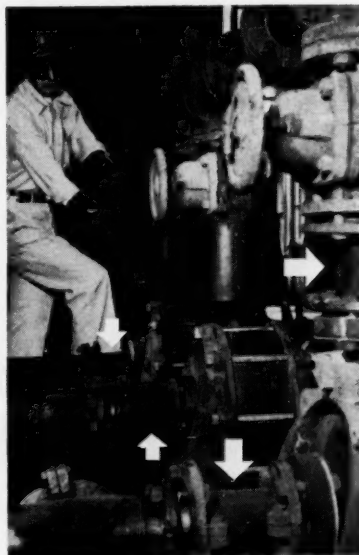
Chemical producer switched
to neoprene when pump vibration
cracked regular fittings

One of the country's largest chemical manufacturers handles great quantities of hydrochloric acid in making end-use products. Pumps are used to distribute acid from the storage tanks to process points. Trouble arose when the fittings connecting pumps to suction and discharge lines cracked under pump vibration. Several rigid non-metallic materials were tried. All withstood the effect of the acid, but failed mechanically under misalignment stress.

Then the company substituted resilient neoprene connectors for the inflexible materials previously used. They worked. Neoprene connectors—resistant to flex fatigue—can compensate for shifting lines... can take distortion without damage. And neoprene connectors are resistant to HCl on the inside, to sunlight and weather on the outside. The change to neoprene saves



Resilient fitting of neoprene takes stress which ruins rigid non-metal types.



Neoprene connectors on acid pumps withstand constant vibration without damage.

this company \$1000 a year in labor and materials.

In tough service such as this, neoprene's *balanced combination* of properties pays off in longer wear, less maintenance. Neoprene resists acids, abrasion, heat, weather, oil and grease. This DuPont synthetic rubber is used in a wide variety of industrial applications where conditions are severe. Hose, belting, gaskets, protective lining, safety clothing are examples. Mail coupon below for details on how neoprene can save you labor and expense.

ELASTOMERS IN ACTION HYPALON® • NEOPRENE

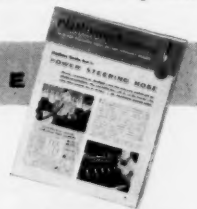


Better Things for Better Living
... through Chemistry

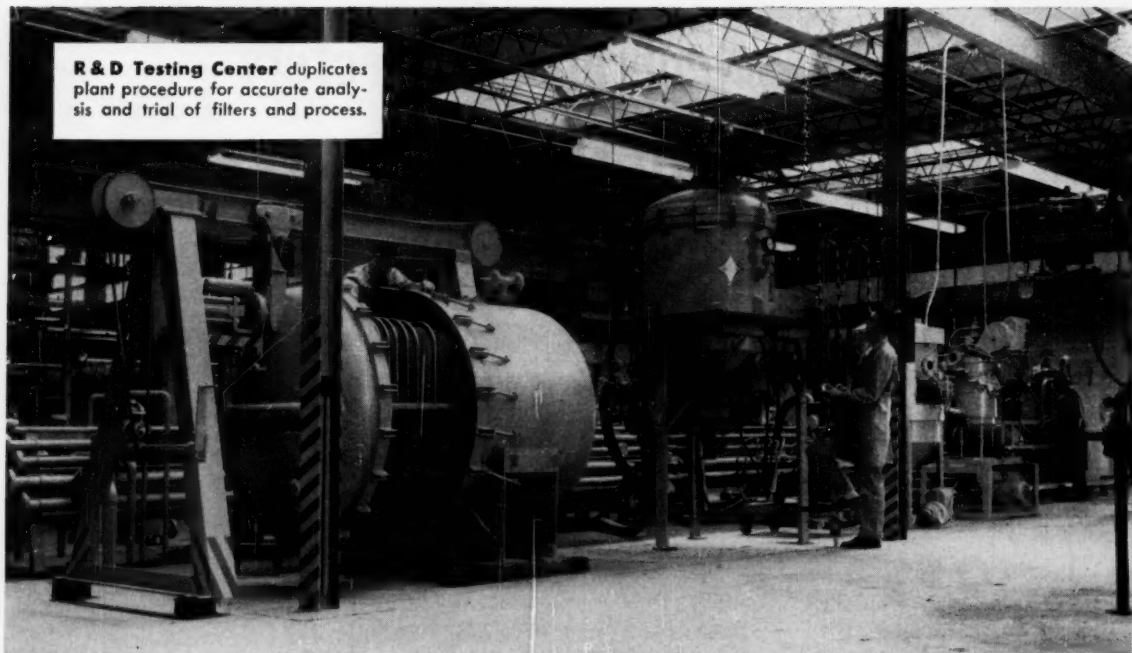
- ☐ I am particularly interested in _____
- ☐ Please add my name to the mailing list for your free publication, the ELASTOMERS NOTEBOOK.

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. CE-1
Wilmington 98, Delaware

Name _____
Firm _____
Address _____
City _____ State _____



R & D Testing Center duplicates plant procedure for accurate analysis and trial of filters and process.



New Research Center analyzes filtration under full-scale process conditions

Industrial's Research and Development Division helps you select filters and study processes without disturbing production in your own plant.

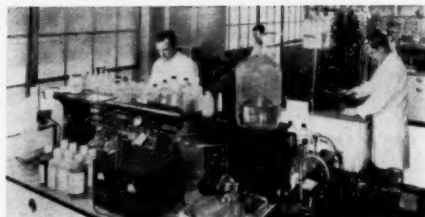
Maximum efficiency in filtration can only be gained by **examining filters and the process in actual operation.**

To do this, Industrial can place at your disposal \$250,000 worth of equipment and a staff of chemists, engineers and physicists experienced in the problems of liquid-solid separation.

The Testing Center includes all types of pressure filters, batch and slurry tanks, heating and cooling systems, chemical addition systems, and various pumps... all interconnected with an ingenious valve and piping system. **Any conceivable process condition can be duplicated at Industrial.** Fluids can be routed from batch or slurry tanks to any filter to test its effectiveness, operating efficiency, and make rapid comparisons of filter types. The process itself can be studied thoroughly and **comparative data on variations is obtained in minutes** instead of days of costly experimentation in your plant.

Industrial builds filters for your processes with the same scientific approach and practical engineering skills that produced this advanced analytical center.

Talking to an Industrial field engineer will put you in touch with the most capable staff and research facilities available today. Bring your filtration problems to Industrial. We will be glad to make analyses and recommendations.



R & D Chemical Laboratory checks and maintains quality control of influent and provides precise analyses of effluent during testing and research operations.



R & D Physical Lab... analyzes densities, viscosities and other physical properties of process fluids... enables engineers to check filters and make pilot runs under simulated conditions.

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.
5918 OGDEN AVENUE • CHICAGO 50, ILLINOIS

If you need **TIGHT** connections

you need

EVER-TITE QUICK COUPLINGS for safe transfer of your products

Here's proof EVER-TITE excels in
speed... safety... economy



Superior quality forged body
—precision machined

Uniform wall thickness
—no weak spots

Extra heavy reinforcing rim

Larger diameter cam ears
for longer service life

Extra
Hi-Strength
forged
handles
—greater
economy

Stainless
Steel
pins
—greater
safety and
longer
service

Uniform heavy
wall thickness
—no weak spots

Recess retains gasket
in coupler and assures
proper placement

Superior quality forged body
—precision machined
—accurate tolerances

Get a QUICK COUPLE every time

You can *speed work—prevent leakage—save wear on equipment* by using an EVER-TITE in every operation that calls for couplings. Ever-Tite always gives you tight, quick connections because Ever-Tite has positive gasket compression that is dependable under *all* conditions. Get Ever-Tites—get a *quick, safe, tight* couple every time. Ever-Tites are available in:

STAINLESS STEEL

Aluminum • Malleable Iron • Brass

Other materials on request

Send for full details now



GASKETS



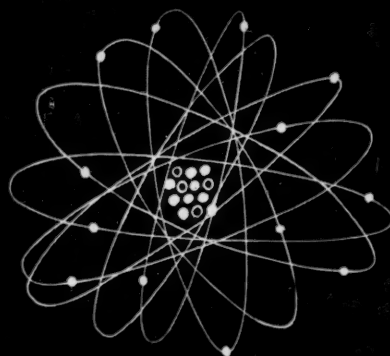
HANDLES



DUST
PROTECTORS

Chain for attaching Dust Caps on
Dust Plugs to adapters or couplers

EVER-TITE COUPLING CO. INC., 254 WEST 54TH STREET, NEW YORK 19, N. Y.



$$E=mc^2$$

Atomic power in Caesar's day?

Certainly!

It was there, in the ground, in the air and water. It always had been. There are no more "raw materials" today than there were when Rome ruled the world.

The only thing new is knowledge . . . knowledge of how to get at and rearrange raw materials. Every invention of modern times was "available" to Rameses, Caesar, Charlemagne.

In this sense, then, we have available *today* in existing raw materials the inventions that can make our lives longer, happier, and inconceivably easier. We need only *knowledge* to bring them into reality.

Could there possibly be a better argument for the strengthening of our *sources* of knowledge—our colleges and universities? Can we possibly deny that the welfare, progress—indeed the very *fate*—of our nation depends on the quality of knowledge generated and transmitted by these institutions of higher learning?

It is almost unbelievable that a society such as ours, which has profited so vastly from an accelerated accumulation of knowledge, should allow anything to threaten the wellsprings of our learning.

Yet this is the case

The crisis that confronts our colleges today threatens to weaken seriously their ability to produce the kind of graduates who can assimilate and carry forward our rich heritage of learning.

The crisis is composed of several elements: a salary scale that is driving away from teaching the kind of mind *most qualified* to teach; overcrowded classrooms; and a mounting pressure for enrollment that will *double* by 1967.

In a very real sense our personal and national progress depends on our colleges. They *must* have our aid.

Help the colleges or universities of your choice. Help them plan for stronger faculties and expansion. The returns will be greater than you think.

If you want to know what the college crisis means to you, write for a free booklet to: HIGHER EDUCATION, Box 36, Times Square Station, New York 36, New York.



Sponsored as a public service, in cooperation with the Council for Financial Aid to Education

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P.L.&R.)
NEW YORK, N. Y.

BUSINESS REPLY CARD

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

—4¢ POSTAGE WILL BE PAID BY—

Chemical Engineering
READER SERVICE DEPARTMENT
330 WEST 42nd ST.
NEW YORK 36, N. Y.

THIS CARD is your shopping basket in our supermarket of technical information, ideas and data. Tear it out now and—
with your pencil—help yourself to the free assistance that *Chemical Engineering* and *CE* advertisers want to give.

Chemical Engineering

Reader Service

Products 225

This is your complete guide to what's available by way of
your Reader Service card: Equipment, Materials, Services.

Technical Literature 228

To build up your files and to keep them up-to-date, take
your pick from the hundreds of items now being offered.

Advertisers 246

Here's your guide to industry's most progressive firms and
what they're offering to help you in doing your job better.

Reprints 250

Tabulated and described for your convenience, this list
of our editorial reprints is your key to current technology.

3-Way Subscription Service

1. For new subscriptions.....
2. Where to send issues.....
3. For change of address.....

☐ New subscription order. (1 year at \$3, U. S. rate only. Send no money, we'll bill you later.)
☐ Business address. ☐ Home Street

FROM: Street
City
State
Country
Title
Product or Service
City
State

Be sure to fill this out before mailing
PLEASE PRINT OR TYPE

CIRCLE code numbers for more information. (This Jan. 13 issue card expires Apr. 1, 1958.)

2	28	44b	53-4d	61	91	105	125	183	191f	204	218	230	233A	236C	TR239	243B	R248
4	29	44c	53-4e	62	92A	107	126	185	191g	205	219	230A	233B	236D	BR239	243C	TL249
6	30	44d	53-4f	63	94A	109	127	186	191h	206	220	230B	233C	236E	L240	L244	BL249
7	31	44a	53-4g	64	94B	111	132	187	191i	207	221	230C	233D	236F	R240	R244	TR249
8	32	44f	53-4h	65	94C	113	133	187a	191j	208	227	230D	233E	T237	L241	244A	BR249
9	33	45	53-4i	66	95	114	134	187b	192	209	228	230E	234	B237	R241	244B	T250
10-3	34-5	46	53-4j	67	96A	115	136	187c	193	210	228A	230F	234A	237A	241A	R245	B250
10-3a	36	47	53-4k	68	96B	116	163	188	194	211	228B	230G	234B	237B	241B	245A	T251
10-3b	37	48	53-4l	69	96C	117	165	189	195	212	228C	231	234C	237C	L242	245B	B251
14-5	38	49	53-4m	70	96D	118	167	190	196	212a	226D	231A	234D	T238	R242	245C	TL252
16-7	39	50	53-4n	72	96E	119	169	191	198	212b	229	231B	235	B238	242A	245D	BL252
21	40	51	53-4a	77	96F	119a	171	191a	199	213	229A	231C	235A	238A	242B	T246	TR252
23	41	52	55	79	96G	119b	173	191b	200	214	229B	231D	235B	238B	242C	B246	BR252
24	42	53-4	56	83	97	119c	175	191c	201	215	229C	232	236	238C	L243	T247	262
25	43	53-4a	57	85	99	121	177	191d	202	216	229D	232A	236A	238D	R243	B247	263
26	44	53-4b	58	87	101	122	178	191e	203	217	229E	233	236B	L239	243A	L248	264
27	44a	53-4c	59	89	103	123	180										

REPRINTS: Circle 4 21 22 25 26 28 33 35 36 37 38 40 42 45 46 47 48 49 50 52 54 55
what you want. See 56 57 59 61 62 63 64 65 66 67 68 69 70 72 73 74 75 76 78 79 80 81
p. 478 for descriptions. 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 104
106 107 108 109 111

Reader Service Cards Are Your

USE YOUR PENCIL WHILE YOU READ. MORE INFORMATION

CODE NUMBERS ARE PAGE NUMBERS and the letters identify specific products on a page—
a, b, c, etc. for ads; A, B, C, etc. for editorial

items. And to locate an ad; T (top), B (bottom),
R (right), L (left). The index below is a guide for
advertising pages showing more than one item.

Important—For pages showing more than one
advertised item use this guide to numbers on
cards above.

10-3A All item discussed

- 10-3a Recorders
- 10-3b Controllers

44 All items discussed

- 44a Containers, safety, File 67
- 44b Cabinet, storage
- 44c Containers, safety, File 74
- 44d Dispensers, drum
- 44e Containers, waste
- 44f Safety vents, tank

53-4 All items discussed

- 53-4a Di-Piperitone synthesis
- 53-4b Diborane
- 53-4c Acid, isosebacic
- 53-4d Pipe standard
- 53-4e Wire cloth, titanium
- 53-4f Rubber, silicone
- 53-4g Animal feeds
- 53-4h Plasticizer
- 53-4i Pigments, red
- 53-4j Acid, thioglycolic
- 53-4k Ethyleneurea
- 53-4l Coatings, zinc
- 53-4m Adhesive

- 53-4n Analyzers, gas
- 53-4o Pyridine N-oxide

119 All items discussed

- 119a Turbines, multi-stage
- 119b Turbines, solid-wheel
- 119c Turbines, axial-flow

187 All items discussed

- 187a Valves
- 187b Pails, acid
- 187c Linings, rubber

191 All items discussed

- 191a Agitators & mixers
- 191b Mills, ball
- 191c Samplers
- 191d Crushers, jaw
- 191e Feeders
- 191f Filters, disc
- 191g Flotation equipment
- 191h Concentration tables
- 191i Laboratory equipment
- 191j Dryers

212 All items discussed

- 212a Valves, diaphragm
- 212b Pumps, diaphragm

CIRCLE code numbers for more information (This Jan. 13 issue card expires Apr. 1, 1958.)

2	28	44b	53-4d	61	91	105	125	183	191f	204	218	230	233A	236C	TR239	243B	R248
4	29	44c	53-4e	62	92A	107	126	185	191g	205	219	230A	233B	236D	BR239	243C	TL249
6	30	44d	53-4f	63	94A	109	127	186	191h	206	220	230B	233C	236E	L240	L244	BL249
7	31	44e	53-4g	64	94B	111	132	187	191i	207	221	230C	233D	236F	R240	R244	TR249
8	32	44f	53-4h	65	94C	113	133	187a	191j	208	227	230D	233E	T237	L241	244A	BR249
9	33	45	53-4i	66	95	114	134	187b	192	209	228	230E	234	B237	R241	244B	T250
10-3	34-5	46	53-4j	67	95A	115	135	187c	193	210	228A	230F	234A	237A	241A	R245	B250
10-3a	36	47	53-4k	68	96B	116	163	188	194	211	228B	230G	234B	237B	241B	245A	T251
10-3b	37	48	53-4l	69	96C	117	165	189	195	212	228C	231	234C	237C	L242	245B	B251
14-5	38	49	53-4m	70	96D	118	167	190	196	212a	226D	231A	234D	T238	R242	245C	TL252
16-7	39	50	53-4n	72	96E	119	169	191	198	212b	229	231B	235	B238	242A	245D	BL252
21	40	51	53-4o	77	96F	119a	171	191a	199	213	229A	231C	235A	238A	242B	T246	TR252
23	41	52	55	79	96G	119b	173	191b	200	214	229B	231D	235B	238B	242C	B246	BR252
24	42	53-4	56	83	97	119c	175	191c	201	215	229C	232	236	238C	L243	T247	262
25	43	53-4a	57	85	99	121	177	191d	202	216	229D	232A	236A	238D	R243	B247	263
26	44	53-4b	58	87	101	122	178	191e	203	217	229E	233	236B	L239	243A	L248	264
27	44a	53-4c	59	89	103	123	180										

REPRINTS: Circle 4 21 22 25 26 28 33 35 36 37 38 40 42 45 46 47 48 49 50 52 54 55
 what you want. See 56 57 59 61 62 63 64 65 66 67 68 69 70 72 73 74 75 76 78 79 80 81
 p. 478 for descriptions. 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 104
 106 107 108 109 111

Key to Tomorrow's Problems

ON EQUIPMENT AND PRODUCTS IS YOURS FOR THE ASKING

COMPLETE PRODUCT INDEX of chemicals, materials, equipment and services taken from this issue's advertisements and new products depart-

ments. You can get more information on any item by circling its code number on one of your Reader Service postcards.

Chemicals

Acid
 Fatty228A
 Isoleucic53-4c
 Thioglycolic53-4j
 Adhesives53-4m, 228B
 Aerosols, nitrogen94C
 Alcohol, Polyvinyl228C
 Boron fuel96E
 Carbon dioxide60
 Catalyst Carriers29
 Cellulose acetate butyrate228D
 Chemicals.....53-4, 59, 65, 77, 97
 229A, 229B, 229C, 229D
 Defoamers213
 Diborane53-4b
 Diuretic96F
 DL-piperitone synthesis.....53-4a
 Elastomers219
 Ethyleneurea, TD 1306.....53-4k
 Fatty quaternaries99
 Furfural, bulletin 204.....210
 Glass, borosilicate96G

Hydrogen peroxide229E
 Insecticide96A
 Isotactic propylene.....92A
 Paint ingredient96B
 Peroxides, organic230A
 Petrochemicals230B
 Pigments, red53-4i
 Plastics230C
 Reinforced96C
 Plasticizers53-4h, 230D
 Polyvinyl chloride230E
 Pyridine N-oxide, TD 1310.....53-4o
 Resins94A
 Polyacetal96D
 Thermoplastic230F
 Rubber, silicone53-4f, 230G
 Silicones231A, 231B
 Steel, magnetic.....94B
 Sodium nitrite.....95
 Solvents79, 107, 123
 Sulphur33
 Zinc oxides231C

FREE,
 FAST &
 EASY

More
 information
 about . . .
 • Advertised
 products
 • New Equipment
 • New Chemicals
 • Technical
 Literature

ALSO

• Reprint Orders
 • Subscriptions
 • Address Changes
 Your Reader Service
 card is the fastest
 way to get what you
 want from this issue.

☐ New subscription order. (1 year at \$3, U. S. rate only. Send no money, we'll bill you later.)

☐ Business address. ☐ Home: Street

FROM: Street

TO: Street

Name

Company

Street

1. For new subscriptions.....

2. Where to send issues.....

3. For change of address.....

3-Way Subscription Service

Be sure to fill this out before mailing

PLEASE PRINT OR TYPE

State

State

State

City

City

City

Title

Product or Service

City

State

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P.L.&R)
NEW YORK, N. Y.

BUSINESS REPLY CARD

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

—4¢ POSTAGE WILL BE PAID BY—

Chemical Engineering

READER SERVICE DEPARTMENT

330 WEST 42nd ST.

NEW YORK 36, N. Y.

WE PAY POSTAGE on your requests for additional information about advertising and editorial items in this issue.

PRODUCTS

Equipment

Agitators & Mixers, bul. A2-B4.....191a
Alloys173
Aluminum38
Analyzers
 Gas, TD 130953-4n
 Moisture235B
Anodes68
Anti-noise & pulsation equipment
 TR239
Blowers, bul. 120-B-14.....109
Boilers183, 192
 Bulletin 58667
Burners, bul. 111.....235
Casters & wheels.....L241
Castings, high alloy
 Catalog 3354-G229
Centrifugals113
Closures & nozzles.....125
Coatings171
 Nickel-alloy56
 Zinc, TD 130753-41
Coils, heating234D
Colorimeter236A
Compacting equipment
 Bulletin 07B8836.....127
ComparatorsL239
Compressors9, 63
 Bulletin 167-117
Concentration tables, bul. T1-B3..191h

Condensers, vapor, bul. 129R.....TL252
Connectors & panels
 Bulletin 23-EB246
Control components62
Controls236C, 236B
 Liquid levelBL252
 pH, data sheet 700(2).....26
 Pressure & vacuum233
 Temperature
 Bulletins 1025, 620, 710.....165
Controllers
 Bulletin 9827810-3b
 Liquid level47
Conveyors117
 Belt233E
Couplings221
Coverings & linings, rubber.....177
Crushers, jaw, bul. C12-B12.....191d
Data systems236D
Demineralizers, water169
Dryers
 Book 251137
 Bulletin D4-B2191j
Dumping220
Dust collectors
 Bulletin 80058
 Bulletin W-7456203
Ejectors199
 Steam jet228
Equipment, rubber & plastic.....187
Evaporators42, 34-5, TL249
Fabrication122
 Stainless208

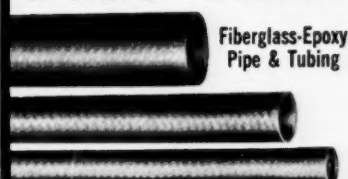
Fans
 Axial flow, bul. 3533-EF.....52
 Centrifugal243A
Feeders, bul. F6-B9.....191e
Felts, bul. VT-2-856.....178
Filter fabric46
Filter media236
 Catalog 57190
Filter presses217
Filters4, 87, 218
 Disc, bul. FG-B1.....191f
Fittings237B
Fittings & flanges, cat. F-9.....163
Flanges48
Floors, bul. 3-3R248
Flooring, steel231D
Flotation equipment
 Bulletin F10-B81.....191g
Furnaces, Isoflow111
GagesR242, T247
 Thickness236E
Gaskets214
 Catalog AD-104.....31
Generators, oxygen & nitrogen.....211
Grating, cat. 252766
Heat exchangers.....105, 216
 Bulletins 120, 124, 135.....B237
Heaters196
 Bulletin SC-156R240
 Thermal liquid, Bul. TLH.....204
Heating systems, Dowtherm
 Bulletin ID-54-5.....83
Hose, metal, Bul. 21-A.....121

PRODUCTS

Indicators, humidity	236F	Steels, stainless	40, 115
Insulation	126	Still, molecular	25
Integrators	43	Strainers, bul. S-205	91
		Switchgear	233C
Jointing, asbestos	180	Tanks	
Joints, expansion	L242	Bulletin 574	201
		Chemical storage	BR239
Kilns, rotary, bul. 1115	32	Tapes, heating	235A
		Thermocouples	
Lift trucks	234A, 234B	Bulletins 4181, 4257	L243
Linings, rubber	187c	Thermo-panels	
		Bulletins 257, 355	TR252
Meters	215	Towers, cooling	16-7
Bulletin 94/10P	198	Tractor-shovels	8
Mills		Tractors	234C
Ball, bul. B2-B13	191b	Tubes, seamless	51
Hammer	30	Tubing, stainless steel	132
Roller	134	Turbines	
Mixers	101, 189, 241A	Axial-flow, bul. S-143	119c
Catalog 78	R244	Multi-stage, bul. S-146	119a
Mixing equipment	241B	Solid-wheel, bul. S-116	119b
Motor-starter combinations		Steam	119
Bulletins MU-128, MU-195	116		
Motor starters, bul. 8210	41	V-belt drive	233D
Motors	23, 263	Valves	167, R245
A. C.	232A	Bulletin 500	57
		Circular AD-2047	133
Nickel	124	Folder 207	185
Nozzles, spray, cat. 24	T250	Bulletin CE-52	187a
		Booklet CE18	202
Ovens, V-bul	T238	Ball	238B, 238C
		Control	238D
Packings, teflon		Diaphragm	36
Bulletin AD-155	195	Booklet #104	212a
Packings & seal cages		Gate, cat. 57	209
Bulletin CP-552	L244	Sampling, bul. J-90	L248
Pails, acid	187b	Stainless steel	118
Pipe standard	53-4d	Valves & pump	212
Pipe	27	Vessels, jacketed, bul. 944	264
Glass, bul. PE-3	21	Voltage regulators, bul. S657	55
Plastic, bul. CE-56	186	Water treatment	T251
Saran lined	89	Welding fittings	6
Pipe & fittings	237C	Wire cloth	206
Pipe & sheet, polyvinyl chloride	262	Catalog E	193
Pipe & tubing	227	Titanium	53-4e
Piping, wrought iron	238A	Wrenches	207
Plastic, PVC, bul. 80-3	136		
Pneumatic transport system	194	X-Ray instruments	237A
Power systems			
Buls. GEA-6375A, GEA-6684	14-5		
Power unit	233A	Services	
Presses, filter	231	Animal feeds	53-4g
Process equipment	191		
Bulletin AH-438-11	230	Cabinet, storage, file 55	44b
Processor, thermal	242A	Clothing, safety	244B
Pulverizers	85	Containers	
Pumps	24, 64, 175, TR249	Safety	
Bulletin 440	39	File 67	44a
Bulletin TLP-57	45	File 74	44c
Bulletin 30-CE	61	Waste, file 57	44e
Acid	49		
Centrifugal	243B, 243C	Dispensers, drum, file 68	44d
Chemical		Disposal containers, lead	245A
Bulletin 203-7	232		
Bulletins C-355, V-837	L240	Fire extinguishers	
Diaphragm, bul. 301	212b	Catalog P-40	234
High vacuum	103	Fire fighting products	245B
Process, bul. 111-ZA	T237		
Rotary, folder 58SC	B250	Glass apparatus	245C
Vacuum, bul. 95	R243		
Pumps & compressors	89	Laboratory crushing, bul. 067	28
Pumps & homogenizers	244A	Laboratory equipment	T246
		Bulletin LG3-B10	191
Reactors, bul. V250	2	Laboratory, testing	B251
Recorders	10-3		
Bulletin 98282	10-3a	Pilot plants	72
Rectifiers	B247	Catalog A	BR249
Reducing equipment	B238		
Refrigeration units	200	Safety equipment	44, 114
Regulators, flow	188	Safety vents, tank	44f
		Sewage disposal	245D
Saddles, bul. S-29	70	Tests, spray drying	BL249
Samplers, bul. S1-B4	191c		
Seals, bul. S-205-2	205		
Separators, screen	242B		
Shredders, bul. 940	BR252		
Solvent recovery	R241		
Speed reducers	233B		
Starch conversion system	242C		

From
Arsenic Trioxide, As_2O_3
To
Zinc Chloride, $ZnCl_2$

FIGHT CORROSION with TUFF-TUBE



Fiberglass-Epoxy
Pipe & Tubing

TUFF-TUBE is the most effective plastic material available to fight corrosion in the chemical, petrochemical, and food processing industries.

Resists thousands of highly corrosive chemicals (acid & alkali), solvents, gases, compounds.

Excellent thermal and electrical insulation: Eliminates problem of electrolysis.

Withstands temperatures up to 400°F and extreme thermal shocks.

Non-magnetic and non-sparking

Requires no maintenance after installation

One-sixth the weight of steel, easily handled on the site.

Smooth inner walls and concentricity insure unobstructed, fast moving flow.

Standard lengths to 10 ft. Tubing diameters down to 1/16 in. Pipe sizes up to 4 in. Wide range of wall thicknesses.

A really tough material—will not weather, rot, or age under severest environmental conditions.

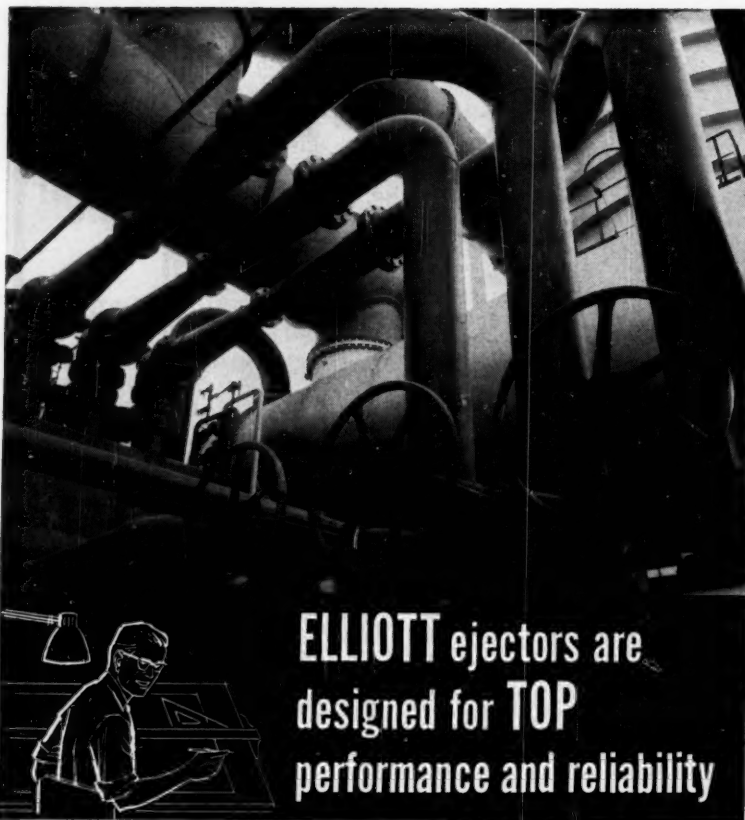
For a one-foot length of laboratory tubing or a one-mile underground pipe, TUFF-TUBE is available for your process operation. And you can expect real savings in three ways—original purchase, easy installation, minimum maintenance.



LAMTEX

INDUSTRIES, INC.

51 STATE STREET • WESTBURY, NEW YORK



ELLIOTT ejectors are
designed for **TOP**
performance and reliability


*... engineered and built
to meet your requirements*

An unusual example of Elliott's engineering experience in designing and building steam jet ejectors and auxiliary equipment for producing vacuum is seen above. This photo shows the three first-stage ejectors of an Elliott triple element two-stage unit which serves a residuum stripper in a California oil refinery.

The vapor load from this vacuum flash unit adds up to approximately 57,000 lb per hr of steam, condensable hydrocarbon vapor and noncondensable gas. To handle this load efficiently and economically requires maintaining approximately 2 in. Hg absolute pressure *continuously*. Two Elliott 11,000-sq ft surface condensers are used, arranged in parallel, and the Elliott triple, two-stage ejector which serves these condensers is discharged to an intercondenser and an after-condenser combined in a common shell.

wide range of single-stage and multistage types

of Elliott steam jet ejectors is available for maintaining low absolute pressures in refineries, chemical plants and other processing industries. For complete data or engineering assistance, call the Elliott ejector specialist at your nearby Elliott District Office, or write Elliott Company, Jeannette, Pa.

ELLIOTT Company 

READER SERVICE . . .

TECHNICAL

Want to build up your files and keep them up-to-date? You can get any publication in this comprehensive guide—free—just for the asking.

It's easy—simply circle item's number on the Reader Service Postcard and mail. Replies will come directly from companies offering the literature.

Chemicals

Acid, Fatty.....Technical Bulletin E-1R2 covers use of Arquad 2HT (dimethyl distearyl quaternary ammonium chloride) in textile treating and paper softening. Based on field experience and lab work.
228A Armour Chemical Div.

Acid, Thiolglycolic.....The properties, reactions and uses of thiolglycolic acid are described in a 20-page catalog now available without charge. Extensive bibliography included. TD 1305.
53-4j *U. S. Industrial Chem. Co.

Adhesive.....New adhesive for polyurethane, made with a new, extremely fast-drying polymer, is said to lose its depression tack faster than any other material on the market. TD 1308.
53-4m *U. S. Industrial Chem. Co.

Adhesives.....10 p. booklet describes in detail expanded operation of Johns-Manville Dutch Brand elastomeric adhesive production facilities. Adhesives can be supplied to meet specific needs.
228B Johns-Manville Sales Corp.

Alcohol, Polyvinyl.....Comprehensive technical manual covers physical properties, modifications, uses of Gelvatol, polyvinyl alcohol. Also included are selected chemical reactions of polyvinyl alcohol.
228C Shawinigan Resins Corp.

Carbon Dioxide.....Liquiflow carbon dioxide system insures absolute product temperature control in pulverization, increases milling capacity. Free booklet, "Applications Unlimited", is offered.
50 *Liquid Carbonic Div.

Cellulose Acetate Butyrate.....75 p. study of chemistry and physical behavior of cellulose acetate butyrate in protective coatings. Contains solubility and compatibility charts; thoroughly indexed.
228D Eastman Chemical Products.

CS-1

*From advertisement, this issue

EDITED BY N. DEGENHARDT

229A . Dow Chemical Co.

229B Olin Mathieson Chem. Corp.

229C Pfanstiehl Laboratories.

229D Union Carbide Chem. Co.

219 *E. I. du Pont de Nemours.

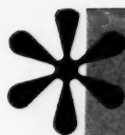
53-4k *U. S. Industrial Chem. Corp.

210 *Quaker Oats Co.

229E Becco Chemical Div.

* From advertisement, this issue

Chemicals and materials.	228
Construction materials. . .	231
Electrical and Mechanical equipment	232
Handling and Packaging.	233
Heating and cooling. . .	234
Instruments and controls.	235
Mechanical equipment. . .	232
Pipe, fittings, valves. . . .	237
Process equipment	240
Pumps, blowers, compres- sors	243
Services and Processes. . .	244



**to help you select
the proper alloy for
your casting specs**

[illegible]

*from pages 6 and 7 of our new General Catalog, No. 3354-G

— and there's lots more useful information about high alloy castings in our up-to-date catalog describing Duraloy Service. SEND FOR YOUR COPY.

As one of the pioneers in both static (1922) and centrifugal (1931) high alloy castings, we have a wealth of experience to focus on your high alloy casting problem. Send for our catalog, study it, and then let us help you get the best alloying combination to solve your corrosion, high temperature and/or abrasion problem.



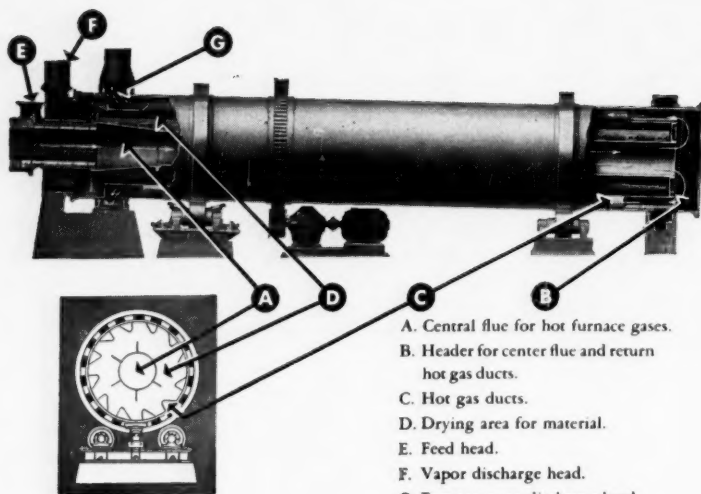
URALOY *Company*
OFFICE AND PLANT: Scottdale, Pa.

EASTERN OFFICE: 12 East 41st Street, New York 17, N. Y.

ATLANTA OFFICE: 76—4th Street, N.W.

CHICAGO OFFICE: 332 South Michigan Avenue

DETROIT OFFICE: 23906 Woodward Avenue, Pleasant Ridge, Mich.

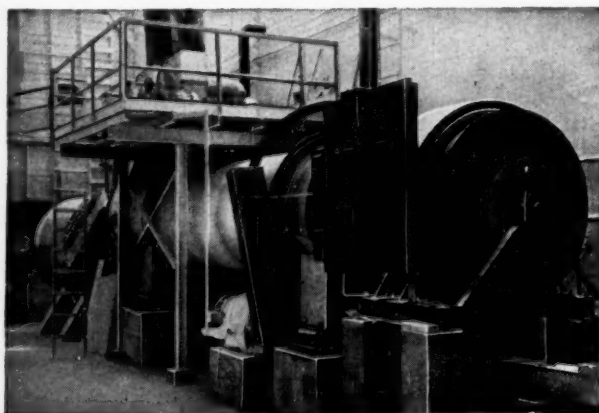


Ruggles-Coles INDIRECT-FIRED DRYERS and HEATERS

- Dry without contamination from combustion gases, regardless of fuel.
- Minimize auxiliary dust collection when handling fine precipitates and filter cake.
- Heat pulverized materials for process work.
- Collect vapors at high concentration.
- Available fabricated with heat and corrosion-resistant metals.



Ruggles-Coles
Indirect
Heat Dryer
handling
200 mesh talc.



Write for Complete Specifications. Ask for Bulletin AH-438-11

HARDINGE

COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

LITERATURE . . .

Peroxides, Organic. Tabulation of stability of various peroxides in both dry and paste forms. Rates of decomposition at different temperatures and changes in appearance are indicated.

230A McKesson & Robbins.

Petrochemicals. 24 p. general product brochure describes line of petrochemicals for paint, plastics, rubber, chemical, petroleum, detergent, agricultural chemicals and other industries.

230B Amoco Chemicals Corp.

Pigments, Red. New series of high molecular weight disazo red pigments for PVC and latex paints is said to combine the strength and brightness of organic pigments with stability. TD 1304.

53-4i *U. S. Industrial Chem. Co.

Plastics. Booklet entitled "Plaskon Plastics and Resins in Brief" outlines characteristics and applications of the complete line of Plaskon plastics and resins available to molders, manufacturers.

230C Barret Div.

Plastic, PVC. Ryertex-Omicron PVC is an exceptionally versatile industrial plastic with outstanding resistance to corrosive solutions and gases. Lightweight and strong. Bulletin 80-3.

136 *Joseph T. Ryerson & Son.

Plasticizer. A new monomeric ester-type plasticizer for vinyls and celluloses is described in a 4-page data sheet. Chemically, it is di-2-ethylhexyl isosebacate. Request TD 1303.

53-4h *U. S. Industrial Chem. Co.

Plasticizers. Technical bulletin presents chemical and physical properties as well as performance characteristics of a line of PVC resin plasticizers known as Polycizers.

230D Harwick Standard Chem. Co.

Polyvinyl Chloride. 23 p. technical bulletin on stabilization of PVC. Deals with barium-cadmium stabilizer systems and applicability of Argus Mark Stabilizers for specific functions.

230E Argus Chemical Corp.

Pyridine N-Oxide. Pyridine n-oxide can now be obtained in commercial quantities. This exceptionally reactive derivative helps prepare many other valuable pyridine chemicals. Request TD 1310.

53-4o *U. S. Industrial Chem. Co.

Resin, Thermoplastic. File folder contains information about Cyclocac high impact thermoplastic resin, including ad reprints, spec sheets listing electrical, chemical, physical properties of 5 Cyclocac types.

230F Marbon Chemical.

Rubber, Silicone. A silicone rubber which vulcanizes at room temperature has just been introduced for encapsulating, potting, sealing and caulking. Request information about TD 1301.

53-4f *U. S. Industrial Chem. Corp.

Rubber, Silicone. Properties of 50, 60 and 70 durometer silicone rubber sheets and fabric-reinforced silicone rubber sheets for -85 F. to 500 F. applications are detailed in 2 p. data sheet.

230G Connecticut Hard Rubber Co.

*From advertisement, this issue

Silicones.....1958 Dow Corning Reference Guide describes over 150 commercially available silicone products. Contains charts, tables, graphs and data on properties and performance. 16 p.
231A Dow Corning Corp.

Silicones.....8 p. data sheet describes properties and uses of six silicone compounds of Union Carbide's 520 series. Compounds are organo-silicone polymers with unusual lubrication properties.
231B Union Carbide Corp.

Solvents.....These solvents are recommended for low odor and odorless products: Shell Sol 71 and 72, Shell 360 solvent, Shell Sol 140 and Shell mineral spirits. Free Booklet offered.
79 *Shell Oil Co.

Zinc Oxides.....48 p. illustrated booklet describes production of St. Joe zinc oxides; their chemical and physical properties; applications in the rubber, paint ceramic and other chemical industries.
231c St. Joseph Lead Co.

Construction Materials

Castings, High Alloy.....New General Catalog 3354-G contains detailed tables to help you select the proper alloy for your casting specifications, along with other useful casting information.
229 *Duraloy Co.

Coatings, Zinc.....Series of zinc rich coatings to protect steel from the atmosphere and in marine and chemical use can be applied by brush or spray, are tougher and tighter than old type. TD 1307.
53-41 *U. S. Industrial Chem. Co.

Felts.....Vistex felts made with Teflon reinforced synthetic fibers give self-lubricating seals. Also available as cut gaskets, strips and washers, and in other materials. Bul. VT-2-856.
178 *American Felt Co.

Floors.....Atlas industrial floors in your pickling and plating rooms will permanently stop corrosive attack. They are made of acid brick laid on an impervious membrane. Bulletin 3-3.
R248 *Atlas Mineral Products.

Flooring, Steel.....Bulletin 50-9 describes five different types of steel for floors, stairs, steps, ramps, catwalks, platforms. Includes tables of safe loads, plate and panel sizes, ordering hints.
231D Joseph T. Ryerson & Son.

Grating.....Grating Catalog 2527 is filled with new ideas in flooring, walkways, stair treads, platforms and shelving. Electroforged steel grating with choice of cross bar and bearing bar design.
66 *Blaw-Knox Co.

Steels, Stainless.....ELC stainless steel assures corrosion resistant welds without troublesome post-weld annealing or costly stabilized stainless grades. "Armco's ELC Stainless Steels."
115 *Armco Steel Corp.

* From advertisement, this issue

DESIGNED TO PROTECT PRODUCTION



Large filter press with rubber-covered cast iron plates and frames.

SHRIVER FILTER PRESSES

Are Made to Protect

- The Equipment
- The Purity of Product

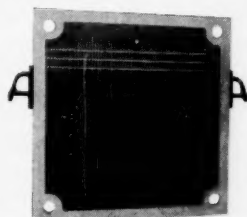
To meet any corrosive, abrasive or other conditions during filtration which may be destructive to equipment or harmful to purity and quality of the material being processed, Shriver Filter Presses can be supplied with plates and frames.

1—Of cast iron or aluminum coated with polyvinyl chloride or other resins, or with rubber.

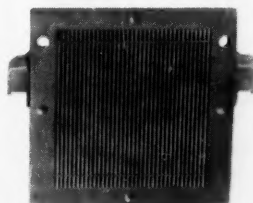
2—Of solid rubber, glass-reinforced polyester, Havg, stainless steel or other alloys.

The factors of suitability, first cost, strength and available filtering area must be considered specifically for each application.

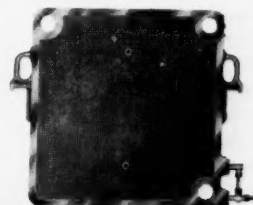
We'll be glad to consult with you on the best means of "protective" filtration.



Polyester plate fiberglass-reinforced.



Solid rubber plate.



Stainless steel plate.

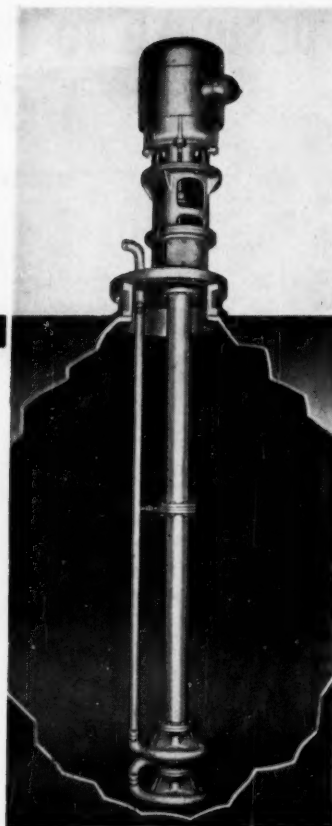
T. SHRIVER & COMPANY, INC.

802 HAMILTON STREET • HARRISON, N. J.

SALES REPRESENTATIVES IN: Decatur, Ga.—Houston, Tex.—Livonia, Mich.—St. Louis, Mo.
San Francisco, Cal.—Montreal, Que.—Toronto, Ont.

FILTER PRESSES • VERTICAL LEAF FILTERS • FILTER MEDIA
HORIZONTAL PLATE FILTERS • CONTINUOUS THICKENERS
SLAB FORMERS • DIAPHRAGM PUMPS • ELECTROLYTIC CELLS

Lawrence 2-Stage Vertical Pump for Pumping Liquid Chlorine out of Tanks.



PUMPS

to handle LIQUID CHLORINE

Pumping liquid chlorine calls for more ingenuity and engineering skill than is available from the average pump manufacturer. Formerly it was pumped pneumatically. This method was attended by a considerable loss of chlorine because the moisture in the air formed hydrochloric acid. A further complication was the corrosive action of the acid vapors.

To overcome this, Lawrence engineers in collaboration with manufacturers of chlorine, developed a pump with a special packing box which prevents any contamination of the chlorine or corrosion of any of the equipment and also prevents the escape of the chlorine fumes to the atmosphere.

For over 80 years Lawrence has been making pumps to handle every acid or chemical fluid used in industry. If you have a particularly difficult chemical pumping problem, we can save you both time and money. Write us the pertinent details, no obligation.

Send for Bulletin 203-7 for a complete summary of acid and chemical pump data.



LAWRENCE PUMPS INC.

371 MARKET STREET, LAWRENCE, MASS.

LITERATURE . . .

Electrical & Mechanical

Anodes. . . . Significant factors in the economical performance of electrolytic cells include the quality, design and machining of these anodes. Company offers a free illustration of cell building. 68
*Great Lakes Carbon Co.

Casters & Wheels. . . . Darnell casters and wheels provide a wide choice of treads suited to all types of floors, are rust-proofed by zinc plating, with bearings packed with good grease. Manual. L241
*Darnell Corp.

Connectors & Panels. . . . Connector panels provide centralized control in transferring any number of thermocouples; quick-coupling connectors give easy making and breaking of circuits. Bul. 23-E. B246
*Thermo Electric Co.

Gaskets. . . . Safe positive sealing at highest temperatures and pressures and under lighter bolt loads is assured with these gaskets, in which you can vary the compressibility. Catalog AD-104. 31
*Garlock Packing Co.

Gaskets. . . . Metallo stock gaskets are made to seal readily and endure the severest attacks of chemical deterioration your process equipment can handle. Immediate delivery. New 20-page catalog. 214
*Metallo Gasket Co.

Motor-Starter Combinations. . . . Wagner increment motor-starter combinations provide low first cost, ease of installation and minimum maintenance. Request helpful Bulletins MU-128 and MU-195. 116
*Wagner Electric Co.

Motor Starters. . . . With company's 2200-4800 volt starters, a push of a button gives you complete protection during starting and running, plus fully automatic synchronization. Bul. 8210. 41
*Electric Controller & Mfg.

Motors, A. C. . . . Photos, drawings and descriptions of totally protected a.c. motors from 1 through 125 hp. are included in Bulletin B-2506. Also availability of NEMA large-frame a.c. motors. 232A
*Reliance Elec. & Engrg. Co.

Packings, Teflon. . . . Chemical Teflon pump packings are impervious to nearly all chemicals, effective for rotating and reciprocating shafts. Also packings for valves. Bul. AD-155. 195
*U. S. Gasket Co.

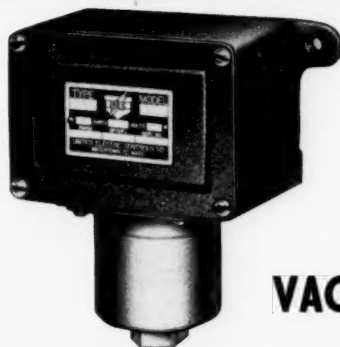
Packings & Seal Cages. . . . Teflon seal cages eliminate scored shafts, last longer than metal lantern rings under corrosive conditions. Teflon ring packings give leak-free service. Bulletin CP552. L244
*Chemical & Power Products.

Power Systems. . . . Bulletin GEA-6375A discusses semiconductor power rectifiers, and Bulletin GEA-6684 describes semiconductor rectifier power conversion system. Request your copies. 14-5
*General Electric Co.

*From advertisement, this issue

AUTOMATIC PRESSURE or VACUUM CONTROL

J6



UE TYPE J6

PRESSURE and VACUUM CONTROL

UNITED ELECTRIC TYPE J6 unit is designed to automatically control either pressure or vacuum . . . has a fixed, uniform on-off differential as specified between limits of 3" WC to 2 PSI . . . and a maximum controlling pressure of 180 PSI. It is a sensitive, weatherproof, precision built control with good repeatability. Recommended for all pressure or vacuum applications which require close on-off differential control.

Switch Differential	Fixed as specified between limits of 3" WC to 2 PSI.
Switch Ratings	15 or 20 amps at 115 or 230 volts AC, also DC switches upon specification.
Switch Types	N.O., N.C., or Double Throw, no neutral position.
Size	4 3/4" x 4 27/32" x 2 5/16".
Weight	Approx. 1 lb. 8 oz.
Electrical Connection	1/2" NPT conduit opening in enclosure, screw type terminals on switch is standard.
Enclosure	Die-cast aluminum case, black wrinkle finish standard.
Mounting	Surface mounted—by 2 mounting ears.
Bellows	Seamless brass—spring loaded.
Pressure Connection	1/4" NPT female connection.

UNITED ELECTRIC manufactures a complete line of temperature, pressure, and vacuum controls. For applications requiring custom-built or modified standard units, call upon a UE application engineer for recommendations. Write for complete specification and pricing data on the Type J6 control. Similar data available on all other UE controls.



United Electric Controls
COMPANY

85 SCHOOL STREET, WATERTOWN, MASS.

Power Unit. 8 p. catalog, MS-1247, describes B-125 power unit. Two large cutaways of unit are shown, along with B-125 specs and a list of special equipment available to expand versatility of engine.
233A Allis-Chalmers Mfg. Co.

Saddles. If your present packed columns are using either Raschig rings or Berl saddles, you can increase throughput substantially by re-packing your towers with Intalox saddles. Bulletin S-29.
70 *U. S. Stoneware Co.

Seals. John Crane Type 9 seals are recommended for all industrial chemicals, corrosives, liquids or gases. The sealing members are made of chemically inert Teflon. Request Bulletin S-205-2.
205 *Crane Packing Co.

Speed Reducers. 40 p. booklet contains description of various worm gear speed reducer designs with hp. ranging from less than 0.1 to 121. Drawings and spec tables show designs, ratings for standard units.
233B Hewitt-Robins.

Switchgear. Major operating and maintenance innovations of new K-line equipment—low-voltage power circuit breakers and switchboards—are featured in Bulletin No. 6004-C.
20 p.
233C I-T-E Circuit Breaker Co.

Turbines, Axial-Flow. Axial-flow impulse turbines, built with one, two or three rows of high-grade stainless steel blading, combine efficiency with durability. Send for Bulletin S-143.
119c *Terry Steam Turbine Co.

Turbines, Multi-Stage. High efficiency units may be designed for non-condensing, condensing, mixed pressure or bleeder operation. Sizes up to 5000 HP. Request Bulletin S-146.
119a *Terry Steam Turbine Co.

Turbines, Solid-Wheel. Solid-wheel turbines are famous for sure dependability and ease of inspection and can be started cold, without any preliminary warming. Request a copy of Bulletin S-116.
119b *Terry Steam Turbine Co.

V-Belt Drive. 108 p. comprehensive manual on selection of Dodge V-belt drives. Arranged in sections covering standard, variable speed and special drives, Taper-Lock Sheaves, Sealed-Life V-belts.
233D Dodge Mfg. Corp.

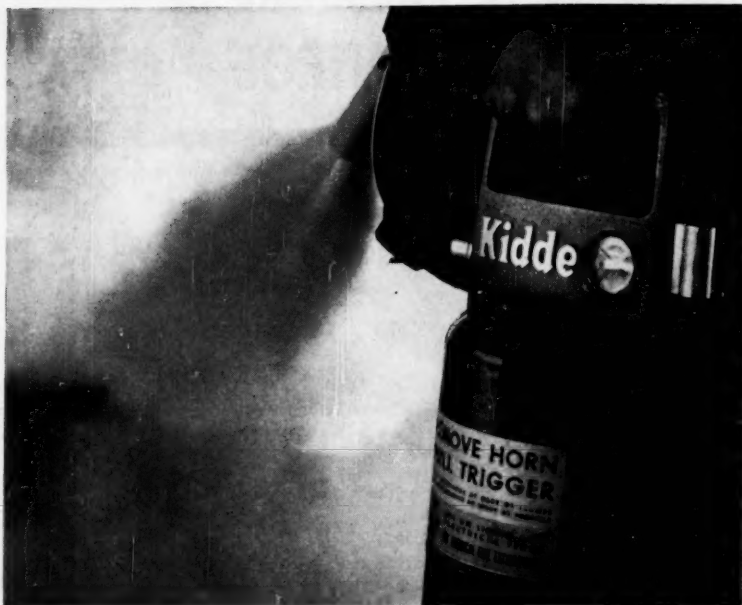
Voltage Regulators. Stabilize automatic voltage regulators hold output voltage constant and end production troubles caused by voltage variations. Request a copy of helpful Bulletin S657.
55 *Superior Electric Co.

Handling & Packaging

Conveyors, Belt. Bulletin BCB-101 covers design, specs, operating details of Carpco sliding type belt conveyors. Units handle wet or dry, lumpy or granular, smooth or abrasive materials.
233E Carpco Mfg.

*From advertisement, this issue

NEW FROM KIDDE!



ALL-NEW DRY CHEMICAL EXTINGUISHER KILLS FIRE FASTER, EASIER!



Kidde's new pressurized dry chemical portables awarded top U.L. rating! This means you can attack flammable liquid or electrical fires with confidence. Automatic unlocking device and trigger control mean easier, faster operation. Just follow simple directions . . . REMOVE HORN, PULL TRIGGER — instantly dry chemical knocks out fires. Other new features include extra-large aluminum handle — use with gloves on. Center-balanced—easier to carry. The plastic-faced pressure gauge is recessed for protection, tells at a glance if unit is ready to use. Available in both 20 and 30 lb. capacities.

Kidde



Walter Kidde & Company, Inc., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd., Montreal—Toronto

FREE INFORMATION

WALTER KIDDE & COMPANY, INC.,
128 MAIN STREET, BELLEVILLE 9, N. J.

Check appropriate box, tear out, mail this coupon for prices, literature!

- ☐ Please send me your new P-40 fire extinguishing and detecting equipment catalog.
- ☐ Please send me prices and specifications for your new dry chemical extinguisher.



P-40
Catalog

NAME _____

ADDRESS _____

CITY _____

STATE _____

LITERATURE . . .

Lift Truck "Preventive Maintenance Service Manual" gives helpful tips on care and servicing of materials handling equipment. 32-point checklist helps users avoid unnecessary repairs.
234A Towmotor Corp.

Lift Trucks "Mechanical and Hydraulic Hand Lift Trucks" is title of 16 p. brochure answering four questions—what they are, how they operate, how to select and how to use them.
234B Assn. of Lift Truck Mfr.

Pails, Acid Ace-Hard acid pails are made of a new, rubber-plastic material that's tough, resilient, suitable for handling most acids and alkalis. Drip-proof spout. Write for name of nearest dealer.
187b *Amer. Hard Rubber Co.

Tanks Day bulk storage tanks save container costs, labor, storage space; improve sanitation and plant housekeeping. Bulletin 574 describes tanks and other materials handling equipment.
201 *Day Co.

Tanks, Chemical Storage Company supplies the chemical processing industry with tanks and vessels for chemical storage made of carbon and stainless steel, aluminum and alloys. Tank Talks.
BR239 *R. D. Cole Mfg. Co.

Tractors BU-337A outlines engineering, design and construction features along with operating data and specs covering TG-45 and TG-50 industrial towing tractors. Complete with photos and graphs.
234C Allis-Chalmers Mfg. Co.

Heating & Cooling

Boilers Company offers free 1 inch scale template of complete vapor modulating water tube boiler line for you to select the size boiler you need. Also free Bulletin 586 is available.
67 *Vapor Heating Corp.

Burners Vortex burners give rapid, clean combustion on a wide range of fuels, including light oil, gas and liquid organic wastes. Instant ignition even when cold. Bulletin 111.
235 *Thermal Research & Engrg.

Coils, Heating "Westinghouse Heavy Duty Steam Heating Coils" is 12 p. booklet giving selection data and suggested piping arrangement, as well as diagrams and description of extra-heavy iron heating coil.
234D Westinghouse Electric Corp.

Condensers, Vapor Aero air-cooled vapor condensers give more capacity than other types at a substantial saving of steam and power. No water supply or scaling problems. Bulletin 129R.
TL252 *Niagara Blower Co.

Evaporators A 12-page brochure entitled "An Open Door" shows how Swenson engineering assists in solving many evaporation, pulp washing, crystallization, filtration and spray drying problems.
34-5 *Swenson Evaporator Co.

* From advertisement, this issue

Evaporators..... Vapor compression evaporators produce distilled water for energy-cost as low as 51 cents per thousand gallons. Many types of units offered. Request Vapor Compression Cat.
42 *Cleaver-Brooks Co.

Heat Exchangers..... With Aero heat exchangers you can cool liquids, gases or vapors with atmospheric air, removing heat at the rate of input and controlling temperature precisely. Buls. 120, 124, 135.
B237 *Niagara Blower Co.

Heaters..... Immersion heating units put the heat where you want it, instead of out in the plant or up the stack. And gas firing gives considerable savings over electricity. Bulletin SC-156.
R240 *Surface Combustion Corp.

Heaters, Thermal Liquid..... Thermal liquid heaters provide safe, low pressure process heat to 750 degrees F., plus pinpoint temperature control. Dependable and economical. Bulletin TLH.
204 *International Boiler Works.

Heating Systems, Dowtherm..... Foster-Wheeler will do the complete job of designing and building a vaporizer for you, installing it in your plant and putting it on stream. Bulletin ID-54-5.
83 *Foster Wheeler Corp.

Kilns, Rotary..... Traylor rotary kilns have all welded steel shells, feed and discharge end seals, improved kiln feeders, single support type roller bearings. Bulletin 1155.
32 *Traylor Eng. & Mfg. Co.

Ovens..... Company's ovens have many uses; for instance, one is used to anneal parts and bake finishes on plastic pitchers for a Minnesota company. Helpful V-Bulletin is made available to you.
T238 *Despatch Oven Co.

Tapes, Heating..... 6 p. bulletin describes new electrical heating tapes that can be cut with a scissors to required lengths. Bulletin also gives data on uses with glass and metal equipment.
235A Arthur S. LaPine & Co.

Thermo-panels..... Company's thermopanel coils weigh less than pipe coils, use less space and are more efficient and more economical. They have no electrical hazards. Request Bulletins 257 & 355.
TR252 *Dean Products Inc.

Instruments & Controls

Analyzers, Gas..... A gas analyzer for measuring trace hydrogen, oxygen and nitrogen in metals has just been introduced for use right in the mill. For both vacuum fusion and extraction. TD 1309.
53-rn *U. S. Industrial Chem. Co.

Analyzers, Moisture..... Model 104 NMR analyzer is designed for the quantitative measurement of hydrogenous liquids (water and oils) in solid materials. Console and magnet unit. Tech Talk 1.
235B Schlumberger Well Surveying.

* From advertisement, this issue

**rapid
short flame combustion
...even on residual fuel oil**

T H E R M A L

V O R T E X B U R N E R

Here is a versatile unit that gives rapid, clean combustion on a wide range of fuels including Bunker C, No. 6, light oil, any gas... even liquid organic wastes.

Combustion is 80% completed within the burner itself and takes place with a whirling, short flame that attains heat release rates of over 1,000,000 BTU/hr per cu ft. Products of combustion are clean and sufficient excess air for tempering the products may be introduced through the burner itself without causing smoke or instability.

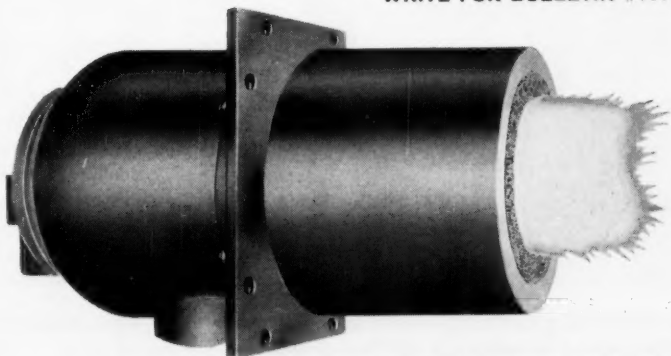
**standard models
available...**

Complete units from 3,500,000 BTU/hr to 50,000,000 BTU/hr are available and may be fitted for steam, compressed air or mechanical atomization. With dual fuel arrangements switching from gas to oil is accomplished without shutdown.

instant ignition...

Gas-electric or torch ignition allows full ignition in a few seconds—even with a cold burner.

WRITE FOR BULLETIN #111



OTHER THERMAL PRODUCTS & SERVICES
Gas, Oil & Combination Gas-Oil Burners • Heat Exchangers • Air Heaters • Submerged Combustion • Gas Generators • Combustion & Heat Transfer Engineering



T H E R M A L

Thermal Research & Engineering Corp.

CONSHOHOCKEN • PENNSYLVANIA

REPRESENTATIVES IN PRINCIPAL CITIES



N.F.M. makes a FULL LINE of Filter Media!

**Call on NFM
for Filter Cloths
made from:**

VINCEL	ORLON**
DYNEL	TEFLON***
NYLON	GLASS
SARAN	POLYETHYLENE
DACRON*	POLYMAX†

FILTER MEDIA HEADQUARTERS
BOOTH 1113

We offer you a full line from which to find the answer to your filter cloth problems. These cloths cover a wide range of resistance to heat, resistance to attack by acids, mold, fungi, alkalis and bacteria, retention of fines, etc. And, because we make a number of different cloths, we are in a position to recommend the best cloth to solve your problem. Our policy is to provide you with the best cloth available to do the job.

For test samples, and recommendations based on our many years of experience, write us giving full details of your filter operations.

Remember, too, we have facilities for making up filter element covers from any of the available fibers, sewed with thread of the same resistance properties as the yarn that goes into the cloth.

*TM — Du Pont Polyester Fiber
**TM — Du Pont Acrylic Fiber
***TM — Du Pont Tetrafluorethylene Fiber
†TM — National Filter Media Corporation



General Offices and Mills: New Haven 14, Conn.
Western Office and Factory: Salt Lake City 10, Utah
Sales Offices—Representatives

Los Angeles, Calif.: 416 West 8th Street
Chicago, Ill.: 6034 N. Cicero Ave.
Elizabethton, Tenn.: Paul Chapman Assoc., Box 787

Cincinnati, Ohio: Roselawn Center Bldg.
Houston, Texas: 1503 Hadley Street
Pensacola, Fla.: Chem-Quip Co., 1102 Texar Drive

LITERATURE . . .

Colorimeter. Bulletin 4000 gives descriptions and specs for standard Beckman flow colorimeter and new Model 77, ratio recording flow colorimeter. Photos and detailed drawings included.
236A Beckman Instruments.

Comparators. Taylor comparators allow you to make fast, accurate colorimeter tests for pH, chlorine, phosphate or nitrates, etc., right on the spot. Request "Modern pH and Chlorine Control".
L239 *W. A. Taylor & Co.

Controls. Nine basic types of temperature and pressure controls are described in 12 p. booklet. Covers self-operating regulators, water mixing equipment, pneumatic control instruments.
236B Powers Regulator Co.

Controls. 56-page catalog, illustrated with drawings and photographs, describes line of automatic controls for heating, refrigeration, air conditioning and other applications. Cat. 857.
236C Mercoird Corp.

Control, pH. Process Data Sheet 700(2), "L&N Speedmax Control of Plant Waste Disposal Processes", outlines an approach to industrial waste treatment, with attention to pH control.
26 *Leeds & Northrup.

Controls, Temperature. Company offers Bulletin 1025 on electric indicating temperature controls, Bulletin 620 on self-powered temperature controls, and Bulletin 710 on cooling controls.
165 *Sarco Co.

Controllers. Transcope controller possesses outstanding performance, exceptional adaptability to changes in process requirements, interchangeable components, easy maintenance. Bulletin 98278.
10-3b *Taylor Instrument Co.

Data Systems. Catalog on Series 1200 Data Logger features "building-block" construction and flexible pinboard programming. Also describes 33 typical data-system installations.
236D Fischer & Porter.

Gage, Thickness. N. E. 157 is bulletin on portable pipewall thickness gages. Describes operation of non-destructive method of determining extent of corrosion, scale buildup, erosion on pipe walls.
236E Industrial Nucleonics Corp.

Indicators, Humidity. 6 p. catalog describes design and construction details for complete line of Serdex humidity indicators, recorders and controllers. Photographs are included.
236F Serdex.

Meters. New stainless steel meter achieves fine-instrument accuracy in the processing of corrosive liquids, in batching, blending, transfer, cost accounting, etc. Request Bulletin 94/10P.
198 *Neptune Meter Co.

Recorders. New 90J Series Transcope recorder has front-of-panel control settings for easy adjustments, stays on automatic control while the recorder is removed for inspection. Form 98282.
10-Ba *Taylor Instrument Co.

*From advertisement, this issue

Thermocouples.....Bulletin 4181 lists thermocouples and accessories of all types and alloys for temperatures from —100 degrees to 3000 degrees F. Bulletin 4257 lists surface temperature thermocouples. L243 *Illinois Testing Labs.

X-Ray Instruments.....12 p. booklet gives engineering data on newest Norelco X-ray instruments for element analysis and structure determinations. Well illustrated, includes instrument specs. 237A Philips Electronics

Pipe, Fittings, Valves

Fittings.....12 p. booklet describes APV Para-Seal all-stainless fittings. Complete illustrated description of design of Para-Seal union and seal ring plus design advantages are given. 237B APV Co.

Fittings & Flanges.....Vogt drop forged steel fittings and flanges have unmatched strength and toughness for your most severe pipeline duties. Uniform in structure. Catalog F-9. 163 *Henry Vogt Machine Co.

Flanges.....Two conveniently located factory warehouses are prepared to ship immediately regular types and sizes of forged steel pipe flanges. Request handy, pocket-sized 36-page reference booklet. 48 *Phoenix Mfg. Co.

Hose, Metal.....Flexible stainless steel hose stands up to high temperature and high pressure corrosive gases and liquids and is strong, light and durable. Request Bulletin 21-A now. 121 *Atlantic Metal Hose Co.

Joints, Expansion.....Penflex expansion joints for volatiles and gases, made of flexible metallic hose for leakproof security and static protection, in several materials. Booklet. L242 *Pa. Flexible Metallic Tubing.

Nozzles, Spray.....Company performs research on the variables of nozzle design, fluid properties and operating conditions. Send for a copy of 48-page Catalog 24 for full information. T250 *Spraying Systems Co.

Pipe.....Attractive illustrated 16-page booklet tells the story of Flori-Houston pipe fabrication service, illustrating equipment, fabrication processes and several case histories. 27 *Flori Pipe Co.

Pipe & Fittings.....16-page bulletin describes line of acid resistant pipe and fittings made of a high silicon iron alloy. Contains drawings and tables of specifications. Bulletin PF/4b. 237e Duriron Co.

Pipe, Glass.....Pyrex glass pipe is strong, transparent and cannot corrode or contaminate. It is easy to clean and to install. Made to take pressure, heat and mechanical abuse. Bulletin PE-3. 21 *Corning Glass Works.

Pipe, Plastic.....Riviclor rigid corrosion-resistant plastic pipe has excellent aging characteristics, high

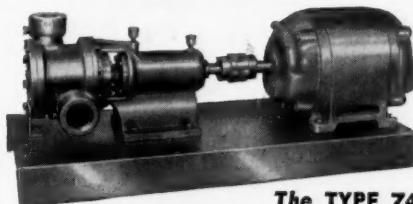
*From advertisement, this issue

Is the Handling of

LIQUEFIED PETROLEUM GASES, REFRIGERANTS
and other LIGHT NON-VISCOUS LIQUIDS

Bothersome to You?

IT NEED NOT BE



The TYPE Z4

AURORA® APCO Process PUMPS

WRITE
for
BULLETIN
111-ZA

AURORA
Always
PUMPS

You are urged to get acquainted with this complete answer to many of the most difficult pumping tasks of modern industry. The characteristics of the most advanced turbine-type pump, the APCO, combine with special new design features, special metals where required to insure SURE RESULTS. May we tell you more?

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY

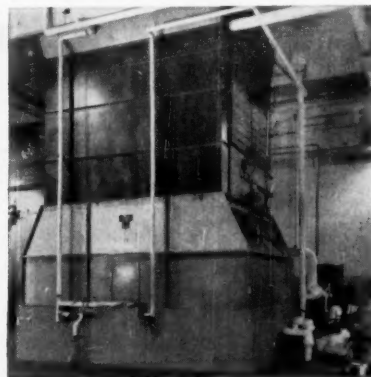
43 LOUCKS ST.

AURORA • ILLINOIS



EXPORT DEPARTMENT — Aurora, Illinois — Cable Address "NYABINT"

WHEREVER YOU NEED
TO COOL A FLUID...
and have a problem
of water supply or
disposal... use
NIAGARA "AERO"
HEAT EXCHANGER



► Evaporating a very small amount of water in an air stream you can cool liquids, gases or vapors with atmospheric air, removing heat at the rate of input, controlling temperature precisely. Save 95% of the cost of cooling water; save piping, pumping and power. You quickly recover your equipment cost.

You can cool and hold accurately the temperature of all fluids, condense

vapors, cool water, oils, solutions, intermediates, coolants for mechanical, electrical or thermal processes. You have a closed system free from dirt. You have solved all problems of water availability, quality or disposal, maintenance expense is low.

You may apply this to solvent recovery, vacuum systems controlling reactions, condensing distillates, cooling reflux products.

For more information, write for Bulletins 120, 124, 135. Address Dept.

NIAGARA BLOWER COMPANY

Dept. CE-1, 405 Lexington Ave., New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

DESPATCH OVEN



Anneals Parts, Bakes Finishes on Plastic Pitchers



WRITE FOR V-BULLETIN



DESPACH OVEN COMPANY

This Despach Electric V-35 Production Oven at N.F.C. Engineering Co., Anoka, Minn., anneals and finishes "Hot 'N Cold" beverage servers made of 100% plastic.

Resin glue mixed with ground acrylic plastic is applied to component parts and clamped in jigs. When joints adhere, pitchers are baked at 150°-200° F. for two hours to anneal all parts together permanently.

Automatic temperature control assures top volume production. When temperature is set, heat remains uniform throughout the baking cycle. Sliding shelves permit fast loading and unloading and the size of the V-35 oven handles up to 200 pitchers at a time. The 650° F. temperature capacity also enables N.F.C. to use their Despach oven for baking standard and wrinkle finishes on metal parts for other products.

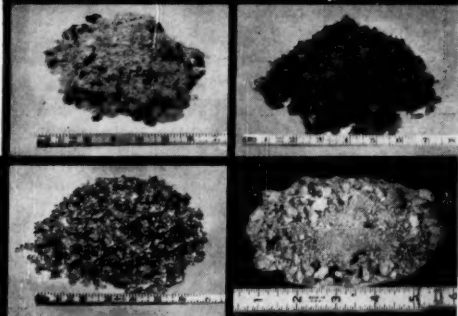
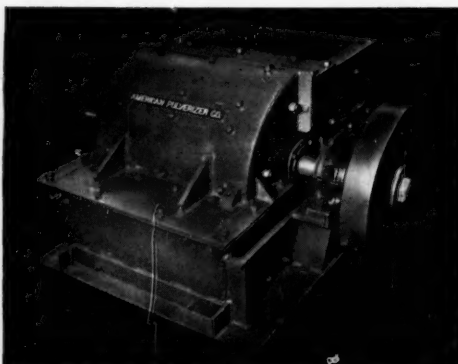
405 DESPACH BLDG.
MINNEAPOLIS 14, MINNESOTA

FOR REDUCING OR
SALVAGING MATERIALS
it's profitable to consult

American

Got a waste product problem?
Got tons or pounds of chemicals,
plastics, ceramics, metallics, or any
other material you'd like to reduce
for resale or reuse?

Send samples of any material
you desire to American, and let
our engineers apply their reduction
experience to your particular reduc-
tion or salvage problem. No obliga-
tion. Send samples, not over 50
lbs., F.O.B. St. Louis.



American

PULVERIZER COMPANY

ORIGINATORS AND MANUFACTURERS

OF RING CRUSHERS AND PULVERIZERS

1219 MACKLIND AVE.

SAINT LOUIS 10, MO.

LITERATURE . . .

strength, easy workability, tough-
ness. Non-toxic, non-flammable.
Bulletin CE-56.
186 *Amer. Hard Rubber Co.

Pipe & Sheet, Polyvinyl Chloride.
Rigid Koroseal polyvinyl chloride
is available in tubes, rods, valves
and sheets. It is low in cost, strong,
unaffected by most alkalis and
acids. Bklets.
262 *B. F. Goodrich Ind. Prod.

Piping, Wrought Iron. 8 p. booklet.
"Wrought Iron O.D. Piping," docu-
ments more than a score of typical
commercial and industrial wrought
iron pipe installations. ASTM pipe
specs are included.
238A A. M. Byers Co.

Valves. "sentry" valves are pat-
ented quick-closing latch type and
quick-opening poston type full flow
valves. Sizes run from 1½" to a full
8". Request a copy of Bulletin 500.
57 *Coppus Eng. Corp.

Valves. Ni-Resist alloy cast iron
with 18-8S Mo trim provides the
most economical valves for many
process industries. Substantially
greater resistance to corrosion,
erosion and wear. Bul. AD-2047.
133 *Crane Co.

Valves. Jenkins outside screw and
yoke U-bolt gate valve offers longer
life and reduced maintenance.
Folder 207 describes inside and out-
side screw patterns in various
metals.
185 *Jenkins Bros.

Valves. Bulletin CE-52 describes
Ace hard rubber, rubber-lined and
plastic-lined valves for corrosive
applications, in diaphragm, gate
and check types. Also discusses Ace
rubber-lined steel.
187a *Amer. Hard Rubber Co.

Valves. Company's valves for re-
ciprocating pumps will operate
freely under temperature and pres-
sure extremes, with highly corrosive
fluids and in any position. Booklet
CE18 offered.
202 *Durable Mfg. Co.

Valves, Ball. Data sheets #1
through #7 describe line of ball
valves in various materials with ex-
clusive double-seal action, abra-
sion resistance, quarter-turn opera-
tion. Request copies.
238B *Jamesbury Corp.

Valves, Ball. Illustrated folder gives
case histories of company's ball
valves in many applications. They
give leak-proof service, full round
flow, quick opening and closing.
V-Folder 10M-3-57.
238C Rockwood Sprinkler Co.

Valve, Control. Bulletin on new
Cash Standard Type 505 high pres-
sure control valve, designed for 10-
000 psi. service. Construction details,
pressure and temperature ratings.
238D A. W. Cash Co.

Valves, Diaphragm. Company's
diaphragm valves give positive con-
trol on throttle or cut-off for liquids,
gases, corrosive services, slurries, air
and water. Booklet #104.
212a *Hills-McCanna Co.

Valves, Gate. Darling gate valve
principle provides assurance of pro-
longed good behavior and avoidance
of leaks and process interruptions.
Various sizes and metals. Catalog
57.
209 *Darling Valve & Mfg. Co.

*From advertisement, this issue

**why
take chances?
use**

TAYLOR COMPARATORS

for FAST, ACCURATE

**pH,
CHLORINE,
PHOSPHATE**

TESTS

**to insure precise
control**



Taylor Comparators allow you to make fast, accurate colorimetric tests for pH, chlorine, phosphate or nitrates, etc. right on the spot. In a matter of minutes you get correct operational data to help you determine the exact amounts of chemicals needed to properly control crystallization, bleaching, precipitation, extraction or waste treatment. To use, simply fill the middle tube with treated sample, move color standard slide across until sample matches one of the standards. Values are then read directly from the slide.

Taylor Comparators are durable, lightweight, portable. Many serve for several determinations with only a change of color standard slides.

COLOR STANDARDS GUARANTEED

Be sure to use only Taylor reagents and accessories with Taylor Comparators to assure accurate results. All Taylor liquid color standards carry an unlimited guarantee against fading.



SEE YOUR DEALER for Taylor sets or immediate replacement of supplies. Write direct for **FREE HANDBOOK "Modern pH and Chlorine Control"**. Gives theory and application of pH control. Illustrates and describes complete Taylor line.

W. A. TAYLOR AND CO.
414 STEVENSON LANE • BALTIMORE 4, MD.



**LET US TAKE YOUR
NOISE AND PULSATION PROBLEMS
OFF YOUR HANDS**

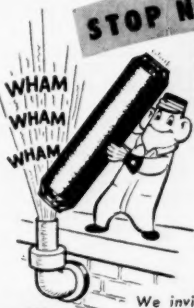
**It is our
engineering
specialty to**

STOP PULSATION

—from surges created
by compressors, pumps,
blowers and pressure reduction
systems.

STOP NOISE

—from intake or discharge
of air, steam or gas
from engines, compressors and
vacuum systems.



The Burgess-Manning Snubbing Principle, engineered to your specific problems, will provide noteworthy savings in operating and installation costs, increased production, reduced maintenance, improved public and employee relations and prevention of compensation claims.

We invite you to present your problems
for recommendations.

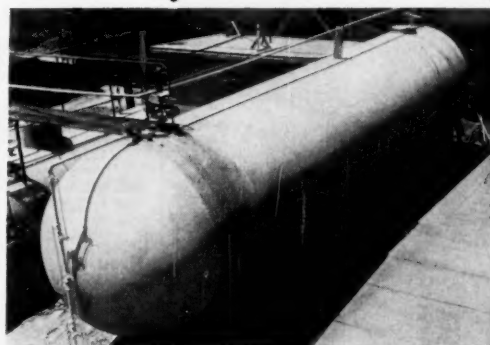


BURGESS-MANNING COMPANY

Service Engineering 723 East Park Avenue, Libertyville, Illinois
Dallas, Texas

TANKS for CHEMICAL STORAGE

**Backed by
103 Years of
Fabrication
Experience**



• We have been supplying the chemical processing industry with tanks and vessels for chemical storage for three generations. In addition to carbon and stainless steel, we also fabricate and erect tanks, pressure vessels and processing equipment of aluminum and special alloys. . . . Investigate our facilities and take advantage of our 103 years of specialized knowledge and experience. . . . Write for *Tank Talks*.



Elevated Tanks, Pressure Vessels, Chemical
and Processing Equipment from Aluminum,
Stainless and Carbon Steel, Monel and
Other Alloys.

Established 1854

R. D. COLE MANUFACTURING CO.
NEWNAN, GEORGIA

for PUMPING CHEMICAL SOLUTIONS!

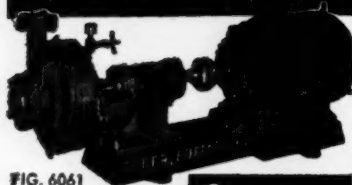


FIG. 6061



Fig. 19,488

Write for
**TABER
BULLETINS
C-355
for
HORIZONTAL
PUMPS
...
for
VERTICAL
PUMPS
V-837**

TABER PUMPS ARE
specially built for
handling chemical solu-
tions, efficiently and
economically... in the
processing industries.
The Vertical design
permits locating stuff-
ing box above and
out of liquid level.
Therefore nothing
to leak.

BULLETINS
as above gladly
sent on request.

TABER PUMP CO.
Est. 1859
320 ELM ST.,
BUFFALO 3, N. Y.

TABER

LITERATURE . . .

Valves, Sampling. Number 90 sam-
pling valve draws off hazardous and
volatile liquid samples for testing.
It is leakproof and instantaneously
self-closing. Request Bulletin J-90
now.
L248 *OPW Corp.

Valves, Stainless Steel. Company's
valves were designed to be cast in
stainless steel, have extra-large
handwheel, deep stuffing box and
bowed yoke. Get "Design Factors in
Stainless Steel Valves".
118 *Cooper Alloy Corp.

Process Equipment

Agitators & Mixers. Patented
standpipe around propeller shaft
assures agitation and circulation.
Heavy duty and acid-proof con-
struction available in several mod-
els. Bulletin A2-B4.
191a *Denver Equipment Co.

Centrifugals. Company manufac-
tures equipment for separation, ex-
traction, dehydration, clarification,
coating, filtration, draining, thick-
ening, impregnation, sedimentation.
Booklet.
113 *Amer. Tool & Machine.

Compacting Equipment. Compact-
ing process assures precise control
of particle size, density and solu-
bility factors. By-product material
is densified, granulated and sep-
arated. Bul. 07B-8836.
127 *Allis-Chalmers Mfg. Co.

Concentration Tables. Mechan-
ically operated, longitudinally recip-
rocating table consisting of a hav-
ing plane surface partly rifled and
a tilting device. Request Bulletin
T1-B3.
191h *Denver Equipment Co.

Crushers, Jaw. Forced-feed jaw
crushers have cast steel frame,
manganese jaw and cheek plates.
Large diameter shafts reduce shaft
deflection and increase bearing life.
Bulletin C12-B12.
191d *Denver Equipment Co.

Dryers. Compact, effective Roto-
Louvre dryer introduces dry, heated
air through ever-changing chan-
nels, assuring uniform drying of
the entire surface of each particle.
Request Book 2511.
37 *Link-Belt Co.

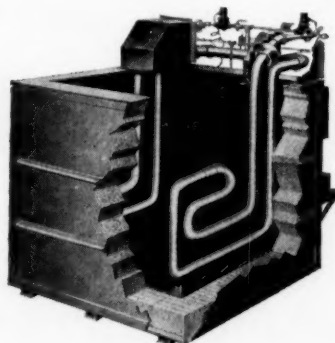
Dryers. Standard dryers are avail-
able in several types: direct heat,
indirect heat and steam tube. No
dryer problem is too large or too
small for Deco engineers. Bulletin
D4-B2.
191j *Denver Equipment Co.

Dust Collectors. Type UW-4 centrifu-
gal wash collector is a basic air
scrubber with extensive applications
for the wet principle collection of
problem dusts and recovery fines.
Bulletin W-7456.
203 *Ducon Co.

Dust Collectors. Company offers a
complete 40-page catalog on Dracco
dust control equipment, with de-
tailed data and valuable reference
material. Several types of filters.
Bulletin 800.
58 *Dracco Corp.

* From advertisement, this issue

GET THE MOST HEAT TRANSFER



PER FUEL DOLLAR

Your fuel dollar buys more effective
heat transfer with 'Surface' immersion
heating than with other methods of
heating liquids and salts.

Diffusion combustion and the heating
tube immersed completely in the liquid
put the heat where you want it, instead
of out in the plant or up the stack. At
the same time, gas firing gives you con-
siderable savings over electricity at
most temperatures.

A temperature range of 100°F to
1200°F is available in 'Surface' im-
mersion heating. Tube design and
materials can meet your specifications.
Safeguards are readily applied to all
'Surface' immersion heating units.

Write for Bulletin SC-156.

Surface Combustion Corporation,
2367 Dorr St., Toledo 1, Ohio

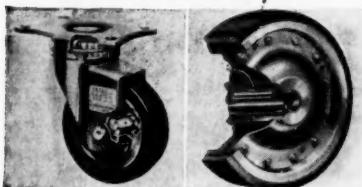


SURFACE COMBUSTION

Also makers of Janitrol® automatic space
heating and Kathabar® humidity conditioning

4

good reasons
to rely on



DARNELL
CASTERS AND WHEELS

1.

RUBBER TREADS . . . a wide choice of treads suited to all types of floors, including Darnelloprene oil, water and chemical-resistant treads, make Darnell Casters and Wheels highly adapted to rough usage.

2.

RUST-PROOFED . . . by zinc plating, Darnell Casters give longer, care-free life wherever water, steam and corroding chemicals are freely used.

3.

LUBRICATION . . . all swivel and wheel bearings are factory packed with a high quality grease that "stands up" under attack by heat and water. Quick grease-gun lubrication provides easy maintenance.

4.

STRING GUARDS . . . Even though string and ravelings may wind around the hub, these string guards insure easy rolling at all times.

Write for Your
Copy Now!



Look in the
YELLOW PAGES
under
CASTERS & WHEELS

DARNELL CORPORATION, LTD.
DOWNEY (LOS ANGELES COUNTY), CALIFORNIA
60 WALKER STREET, NEW YORK 13, NEW YORK
36 NORTH CLINTON STREET, CHICAGO 5, ILLINOIS

LITERATURE . . .

Feeders Wet reagent feeder accurately meters minute quantities of liquid from 0 cc. to 2000 cc. per minute. Simple handwheel adjustment to control amount of liquid. Bulletin F6-B9.

191e *Denver Equipment Co.

Filter Fabric Company offers a handy book of information on filter fabrics entitled, "Filter Fabric Facts". Their filter specialists are always ready to solve filter cloth problems.

46 *Wellington Sears Co.

Filter Media Company makes wire cloth and filter cloth in all alloys and every degree of density down to 400 mesh, filter leaves, screens for presses, tubular filter elements, etc. Cat. 57.

190 *Multi-Metal Wire Cloth Co.

Filter Presses Filter presses can be custom-engineered to meet your particular requirements for flow rate, cake build-up, washing, extraction, thickening, etc. Any filter media used. Catalog.

217 *D. R. Sperry & Co.

Filters, Disc Patented design of segments in disc filters uses both gravity and vacuum to give a drier filter cake. Drainage is complete, with no blow-back. Write for Bulletin FG-B1.

191f *Denver Equipment Co.

Flotation Equipment Flotation is the selective separation of particles from each other of air bubbles. Sub-A's give maximum recovery cheaply. Bul. F10-B81.

191g *Denver Equipment Co.

Mills, Ball Company's steel-head ball mills have five types of discharge trunnions, all-steel construction, low initial cost, quick delivery. Also lab and pilot plant mills. Bulletin B2-B13.

191b *Denver Equipment Co.

Mixers Turbulizer provides fast, thorough dispersion, disintegration and blending of dry materials, or pastes involving liquids and solids. Self cleaning, precision machined. Bulletin.

101 *Strong-Scott Mfg. Co.

Mixers Dispersall mixer disperses, mills and blends (as well as emulsifies) in one operation. Eliminates pre-milling and pre-mixing, gives speed and power. Request Catalog 78.

R244 *Abbe Engineering Co.

Mixers Bulletin 581 shows various types of industrial mixers—three types of high-speed mixers, seven vertical mixers, five types of Type D mixers and eight types of batch mixers.

241A Conn & Co.

Mixing Equipment Illustrated Catalog 15 covers full line of blending equipment, including standard, intensifier and liquid-solids. Twin Shell blenders, and double cone and ribbon blenders.

241B Patterson-Kelley Co.

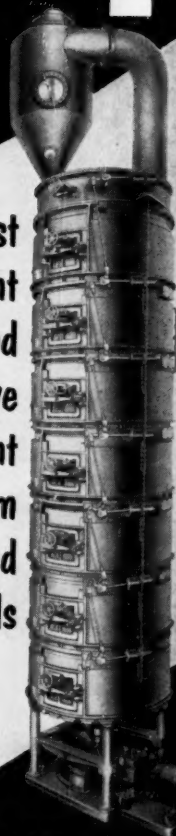
Process Equipment Indirect-fired dryers and heaters dry without contamination from combustion gases, minimize auxiliary dust collection and heat pulverized materials. Bulletin AH-436-11.

230 *Hardinge Co.

* From advertisement, this issue

FRENCH

DT



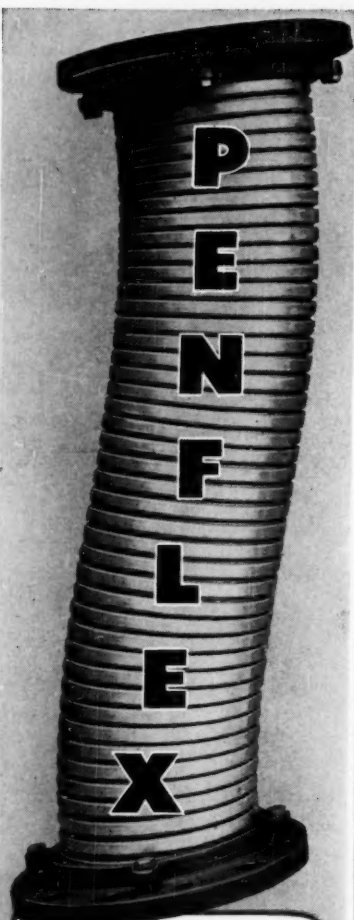
The most
efficient
method
to remove
solvent
from
extracted
solids

Cuts
Solvent Loss
50 to 75%

Increased efficiency in removing solvent from solids during processing provides an excellent opportunity to reduce costs. The French Desolventizer (DT) represents a significant advance in the removal and recovery of solvent from extracted solids. Its efficiency has been proven in many plant applications. Send details of your processing problem.

FO18

THE
FRENCH
OIL MILL MACHINERY CO.
PIQUA, OHIO, U.S.A.



EXPANSION JOINTS FOR VOLATILES AND GASES

Flexible metal hose, for leak-proof security, inherent static protection. Specially designed Titepak flange for holding high pressures for interlocked type of tubing. Pressures to 200 PSI. 2" to 24" I.D. in galvanized steel, stainless steel and bronze . . . with asbestos or special packing lined pressure carrier. Write for booklet to Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Phila. 42.



GET YOUR
COPY

PENFLEX
TIGHT AS A PIPE BUT...
FLEXIBLE

LITERATURE . . .

Processor, Thermal 24 p. catalog describes Turba-Film II Processor, mechanically aided thermal unit which eliminates problems encountered in processing viscous fluids.
242A Rodney Hunt Machine Co.

Reactors Votator continuous reactors provide rigid heat control and complete dispersion of reactants. Free Bulletin V250 gives complete information on applications, specifications.
2 *Girdler Co.

Samplers Automatic, heavy duty samplers have extra rigid track and ball-bearing wheels to assure positive travel and timing of sample cutter. Available in stainless steel. Bulletin S1-B4.
191c *Denver Equipment Co.

Separators, Screen Bulletin S 574-1 describes 30 new Sweco vibrating screen separators, intermediate size between 18-in. and 48-in. dia. units. Operating, application, specification data.
242B Southwestern Engineering Co.

Shredders Obsolete correspondence, confidential records, documents, blueprints, brochures and waste paper can be shredded into a fine mass and baled. Also shreds plastic, fibers. Bulletin 940.
BR252 *Gruendler Crusher & Pulv.

Starch Conversion System The Enzometer, a completely automatic system for enzyme starch conversion, records and controls viscosity and temperature. Request 1-page Bulletin V-1221.
242C Norcross Corp.

Stills, Molecular Molecular stills produce savings in vitamin recovery from natural triglycerides, purification of monoglycerides, isolation of natural oil components, etc. Brochure.
25 *Arthur F. Smith Co.

Strainers Yarway pipeline strainers have screens of Monel wire filter cloth, easily removed screen caps, rust-resistant finish, wide range of sizes and pressures. Bulletin S-205.
91 *Yarnall-Waring Co.

Water Treatment The underdrain system of company's water treating equipment uses no retaining bed. It is suitable for any type of ion exchanger and eliminates underbed distortion. Folder.
T251 *H. M. Mueller Corp.


Wire Cloth Company's wire cloth is accurately woven in a wide range of meshes, ranging from very coarse to extremely fine. Complete lines is available in all malleable metals. Catalog E.
193 *Newark Wire Cloth Co.

Wire Cloth Free 94-page catalog and stock list gives the full range of wire cloth available, describes fabrication facilities and gives useful metallurgical data. Request a copy.
206 *Cambridge Wire Cloth Co.

Pumps, Blowers, Compressors


Blowers Company's centrifugal blowers assure positive control of air delivered; they give you dependable, continuous, efficient operation for long periods of time. Bulletin 120-B-14.
109 *Roots-Connersville Blower

* From advertisement, this issue

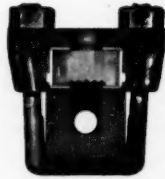


HIGH PRESSURE GAUGES

USED IN
REFINERIES
AND
CHEMICAL PLANTS
THROUGHOUT
THE WORLD




THRU VISION



REFLEX

Single or Multiple
Sections

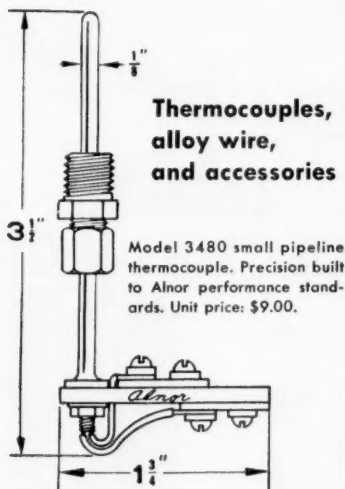
TUBULAR

Gauge Cocks
Large Chamber
Reflex Gauges
Heated or Cooled
Gauges

SEND FOR
COMPLETE
CATALOGUE

STRAHMAN VALVES, Inc.
16 Hudson St., New York 13, U.S.A.

Alnor[®] pyrometer supplies



**Thermocouples,
alloy wire,
and accessories**

Model 3480 small pipeline thermocouple. Precision built to Alnor performance standards. Unit price: \$9.00.

Choice is unlimited at Alnor, where you'll find thermocouples of 1/8" O.D. and smaller, and more unique, proven thermocouple designs than at any other available source. Each thermocouple is individually calibrated for its specific application—all of the same type are interchangeable without recalibrating instrument.

Bulletin 4181... lists thermocouples and accessories of all types and alloys for every temperature measurement from -100° F. to 3000° F., to ISA Standards. Also contains complete engineering information such as alloy curves, uses and limitations of alloys, millivolt relationship tables, etc.

Bulletin 4257... lists surface temperature thermocouples and accessories available from Alnor.

Circle bulletin number you want, attach this ad to your letterhead and mail to: Illinois Testing Laboratories, Inc., Room 559, 420 N. LaSalle St., Chicago 10, Ill.

**PRECISION INSTRUMENTS
FOR EVERY INDUSTRY**



LITERATURE . . .

Compressors.....Bulletin 167-11 tells about Joy oil-free air compressors such as those used by the National Brewing Company to operate recording instruments controlling steam inlets on tanks.
7 *Joy Mfg. Co.

Fans, Axial Flow.....Axial flow fans have extremely high efficiency, quiet operation, built-in rigidity of construction and compact size. Request a copy of helpful Bulletin 3533-EF.
52 *Buffalo Forge Co.

Fans, Centrifugal.....Catalog 1121 describes efficiency and quietness of airfoil blading for all-purpose applications. Series 8000 fans cover needs up to 700,000 cfm. and up to 16 1/2-in. total pressure.
243A Westinghouse Electric Corp.

Pumps.....There is no leakage, no contamination, no prime loss, no stuffing box with Pulsafeeder controlled-volume chemical pump. Bulletin 440 contains typical applications, flow charts, etc.
39 *Lapp Insulator Co.

Pumps.....Twin-Lobe rotary positive displacement pump has simplified design and construction, only three moving parts, high efficiency, smooth action, metering accuracy. Bulletin TLP-57.
45 *Manton-Gaulin Mfg. Co.

Pumps.....Moyno pumps will handle difficult materials such as abrasives, pastes, slurries, chemicals, suspended solids, etc., without foaming, aerating, or crushing. Bulletin 30-CE.
61 *Robbins & Myers Inc.

Pumps, Centrifugal.....Centriseal rubber-lined pumps deliver corrosive slurries undiluted. Auxiliary impeller vanes pump everything away from exposed metal parts. Brochure No. 557.
243B Allen-Sherman-Hoff Pumps Co.

Pumps, Centrifugal.....Hydroseal rubber-lined pumps use controlled flow of clear liquid into stuffing box under pressure to prevent shaft-sleeve erosion, gland leakage. Brochure No. 457.
243C Allen-Sherman-Hoff Pumps Co.

Pumps, Chemical.....For over eighty years Lawrence has specialized in making pumps to handle every acid or chemical fluid used in industry, including liquid chlorine. Request Bulletin 203-7.
232 *Lawrence Pumps Inc.

Pumps, Chemical.....Company offers Bulletin C-355 on horizontal pumps and Bulletin V-837 handling chemical solutions efficiently and economically.
L240 *Taber Pump Co.

Pumps, Diaphragm.....McCannameter diaphragm pump delivers new high pressure range, new broad capacity range, new wide operating speed range, cuts maintenance costs. Booklet #301.
212b *Hills-McCanna Co.

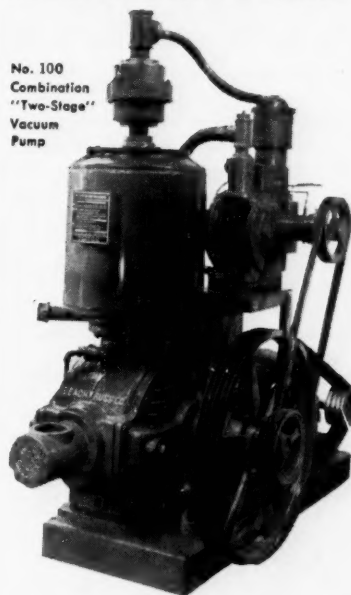
Pumps, High Vacuum.....Company offers literature on their high vacuum pumps of several types and on high vacuum equipment, including evaporators, furnaces, curing ovens and degassing equipment.
103 *Kinney Mfg. Div.

*From advertisement, this issue

the

Beach-Russ

Combination "TWO-STAGE" VACUUM PUMP



No. 100
Combination
"Two-Stage"
Vacuum
Pump

The Beach-Russ Combination "Two-Stage" Vacuum Pump gives tops in service at the low micron range.

- Faster Pump-Down
- Faster Recovery
- Lower Blank-Off Pressure
- Conditioned Oil Supply
- For Dry or Wet Systems

Write today for
NEW "Two-Stage"
Bulletin 95

BEACH-RUSS COMPANY
50 Church St. · New York 7, N. Y.

DOUBLE TROUBLE STOPPED

by **CHEMPRO
TEFLON***

In high speed pumps handling highly corrosive chemicals, Chempro Teflon has drastically cut pump down-time caused by scored shafts and short packing life.

"Scored" Shafts

eliminated by using CHEMPRO TEFLON SEAL CAGES†. Last many times longer than metal lantern rings under continuous corrosive attack. Snap on and off shaft quickly and easily. No vibration at high speeds. Can stand high gland pressures.

(Patented)



Short Packing Life

solved by using CHEMPRO TEFLON RING PACKINGS. Give months of leak-free service compared with days and even hours for conventional packings. Require only slight gland pressure. Low coefficient of friction often makes lubrication unnecessary.

Complete information given in Bulletin CP352



*duPont Trademark



**CHEMICAL & POWER
PRODUCTS, Inc.**

5 Broadway, New York 4, N. Y.

LITERATURE . . .

Pump & Homogenizers. Bulletin describes Hydropulse pumps and homogenizers for processing abrasive, corrosive and sanitary liquids. Also discusses recycling gas compressor. **244A** Scott & Williams Inc.

Pumps, Process. The handling of liquefied petroleum gases, refrigerants and other light, non-viscous liquids need not be bothersome when you use APCO turbine-type pump. Bul. 111-ZA. **T237** *Aurora Pump Div.

Pumps, Rotary. You have many advantages when you buy from the complete line of quality controlled Viking rotary pumps. Over 750 cataloged models. Send for free Folder 58SC now. **B250** *Viking Pump Co.

Pumps, Vacuum. Combination two-stage vacuum pump gives tops in service at the low micron range, with faster pump-down and recovery, lower blank-off pressure, conditioned oil supply. Bul. 95. **R243** *Beach-Russ Co.

Vessels, Jacketed. Stainless steel jacketed processing vessels, kettles and reactors come in a choice of standard designs in types 304 and 316 stainless steel. Bulletin 944 has sizes, specs. **264** *Pfaudler Co.

Services, Processes, Misc.

Animal Feeds. "The Rudiments of Feed Formulation", a 6 page reprint reviewing the industrial sources of animal feed constituents, formation of mixed feeds and their nutrient value, is TD 1302. **53-4g** *U. S. Industrial Chem. Co.

Cabinet, Storage. Time-saving flammable liquids storage cabinet may be located close to work station, permits convenient storage of up to 45 gallons of flammable liquids. File 55. **44b** *Protectoseal Co.

Clothing, Safety. 6 p. booklet offers—in tabular form—comparison of chemical resistance and safety factors of nine families of synthetic fabrics and films available in safety clothing. **244B** Milburn Co.

Containers, Safety. Specially designed safety containers eliminate constant hazard of awkward, hard-to-handle, leaky cans and bottles. Laboratory Safety Equipment File No. 67. **44a** *Protectoseal Co.

Containers, Safety. Special metals, such as stainless steel or monel metals, or hot tin dipped coatings, are often best suited to hold certain corrosive, flammable liquids. Request File 74. **44c** *Protectoseal Co.

Containers, Waste. Safety waste disposal cans located at each work station prevent dangerous pyramiding of wastes within the plant, avoids spontaneous combustion fires. File 57. **44e** *Protectoseal Co.

*From advertisement, this issue



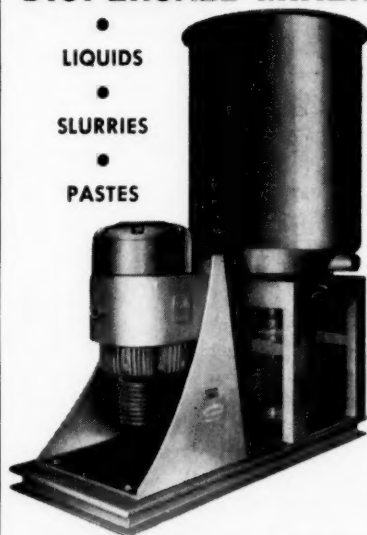
*in
One Operation*

abbé' DISPERSALL MIXER

• LIQUIDS

• SLURRIES

• PASTES



The Abbé Dispersall Mixer disperses, mills and blends (as well as emulsifies) in ONE operation. Solid ingredients are completely dispersed in a fraction of the time required by conventional mixers. Eliminates pre-milling and pre-mixing.

The Abbé Dispersall Mixer gives you speed and power, plus the tremendous advantage of easy cleaning in changing from one product to another. Tooth pastes, ointments, paints, colors and pharmaceuticals, etc., are mixed and dispersed better and faster in the Abbé Dispersall Mixer in a ONE-stage operation. Write for Catalog 78.

abbé' ENGINEERING CO
50 Church Street
New York 7, N. Y.

Designers and Manufacturers of
Ball, Pebble and Jar Mills • Pulverizers
Sifters • Cutters • Mixers

PROCESS INSTRUMENTS and CONTROLS HANDBOOK

Edited by Douglas M. Considine
Hughes Aircraft Co.

Here are the instrumentation techniques to help you detect, measure, record, and control industrial processes. From simple measuring instruments to complex mathematical techniques, you will find here the kind of help that is valuable, time-saving, and based on the best experience in the field. Among subjects covered are measurement standards, measurement systems, indicators and recorders, automatic controllers, timers and program controllers, electric and pneumatic telemetering, final control elements.

Giant fold-out charts

Large fold-out charts at the back of the book describe 104 separate techniques for chemical analysis, covering application, techniques, practical instrumental considerations, cost, etc. Prepared by a staff of specialists. 1383 pp., 1137 illus., \$19.50

JUST OUT!

X-RAY CRYSTAL STRUCTURES

Just Published! Clearly and logically this practical guide takes you through each step in accurately analyzing single crystals by means of modern x-ray procedures. Covers every important aspect of x-ray crystallography, including the theory of space groups, single-crystal cameras, and Fourier methods. By Dan McLachlan, Jr., Stanford Research Inst. 416 pp., 297 illus., \$15.00

MANAGEMENT FOR ENGINEERS

Just Published! A guide for the engineer taking on management relations and responsibilities. Chapters discuss production costs and their control; the basic financial transactions of a business enterprise—insurance, depreciation, taxes, power, labor, materials, etc.; the concepts of authority and responsibility; and the higher level decision-making process. By Roger C. Heimer, Villanova Univ. 453 pp., \$6.75

FREE EXAMINATION

SEE THESE BOOKS 10 DAYS FREE

McGraw-Hill Book Co., Dept. CE-1-13
327 W. 41st St., N.Y.C. 36
Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery costs and return unwanted book(s) postpaid. (We pay delivery cost if you remit with this coupon—same return privilege.)
☐ Considine—Process Inst. & Cont. Hdbk., \$19.50
☐ McLachlan—X-ray Crystal Structures, \$15.00
☐ Heimer—Management for Engineers, \$6.75

(PRINT)

Name

Address

City Zone State

Company

Position

For price and terms outside U. S., CE-1-13
write McGraw-Hill Int'l. NYC.

LITERATURE . . .

Dispensers Drum.....Stainless steel drum dispensers with Teflon gaskets dispense flammables and corrosives safely, without leakage or stripped threads. Send for Drum Dispensing File 68.
44d *Protectoseal Co.

Disposal Containers, Lead.....Edlow lead disposable containers for radioactive waste are warranted solid lead casting, wholly free of voids and pitholes. Catalog sheet with detailed price list.
245A Edlow Lead Co.

Fire Extinguishers.....New dry chemical fire extinguisher fights flammable liquid and electrical fires. All you need to do is remove the horn and pull out the trigger. Catalog P-40.
234 *Walter Kidde & Co.

Fire Fighting Products.....A 12-page catalog describes portable fire fighting products including several types of nozzles, liquid foams, proportioners, wetting agents, etc. Cat. CP-7-50M-51.
245B Rockwood Sprinkler Co.

Glass Apparatus.....24 p. manual on care and handling of glass volumetric apparatus covers systems of weights and measures, capacity tolerances, rules for manipulation of apparatus.
245C Kimble Glass Co.

Laboratory Crushing.....Full information on Sturtevant laboratory crushing rolls, jaw crushers, swing-sledge mills and sample grinders, with easy cleaning, high output. Bulletin 067.
28 *Sturtevant Mill Co.

Laboratory Equipment.....Batch and continuous test models of crushers, screens, ball mills, pulverizers, rod mills, classifiers, mixers, pulp distributors, feeders, pumps, etc. Bulletin LG3-B10.
1911 *Denver Equipment Co.

Pilot Plant.....Company's laboratory can pre-determine for you the advantages of a continuous pressing and drying operation. Continuous mechanical press, two rotary dryers. Catalog A.
BR249 *Davenport Mach. & Foundry

Sewage Disposal.....25 p. booklet describes flash drying and incineration system in which sewage sludge solids are fired in the manner of pulverized coal. Photos and diagrams explain how system works.
245D Combustion Engineering.

Tests, Spray Drying.....You can investigate the advantages of spray drying your product to lower its cost and improve its quality. Bowen test facilities are available. Booklet.
BL249 *Bowen Eng. Inc.



FOR
THE

BIG 42"
JOBS ... or the
small
3/8" ones

Norwalk Engineered Valves
keep gas and air under
positive control

For more than 75 years, Norwalk valves and Norwalk engineers have controlled the flow of gases and air at high and low pressures in pipe sizes from 3/8" to 42 inches. Every Norwalk valve is precision engineered and built to give long years of trouble-free, safe, dependable service at practically no maintenance cost.

Quick delivery, engineering know-how and experience is available from 11 Norwalk factory branches to meet every flow problem.

When you have a flow control problem—**Call Norwalk**



INDUSTRY'S COMPLETE LINE

Check Valves—Pipe Sizes 3/8" to 42".
Screwed End Models to 4".
Manometers—Pressure or Vacuum.
Pressure Controllers—Pressures to 5 psi.
Appliance Regulators—Pipe Sizes 1/2" to 2".
Station Regulators—Pipe Sizes 3" to 24".
Liquid Seal or Diaphragm Types.
Relief Valves—Pipe Sizes 1/2" to 24".
Filters—Pipe Sizes 1/2" and up.

Complete Engineering Cooperation

NORWALK VALVE CO.

Established 1878

SOUTH NORWALK, CONN.

Boston • Chicago • Cleveland • Detroit
Los Angeles • Minneapolis • New York
Philadelphia • Pittsburgh
San Francisco • Washington, D. C.

* From advertisement, this issue

IMPROVE YOUR LABORATORY with MODERN, FUNCTIONAL, EQUIPMENT

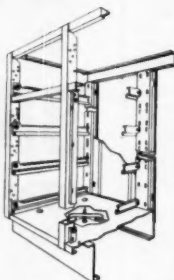


by
METALAB

for
**INDUSTRIAL
EDUCATIONAL
INSTITUTIONAL
HOSPITAL use...**

Cutaway view of our standard base unit: This construction technique permits you to interchange drawers and cupboards by utilizing the same base cabinets as your laboratory requirements change.

METALAB mass-production methods, which have been adapted to custom laboratory equipment and furniture results in "custom" quality units at "standard" prices.



From our vast experience in laying out the nation's finest laboratories, METALAB can show you how to obtain maximum working and storage area in a minimum of space... how to make current equipment adaptable to any possible future needs... and how to achieve true economy in laboratory equipment. This know-how, plus the use of only the finest laboratory-tested materials, assures you of obtaining the most at Metalab for your laboratory budget.

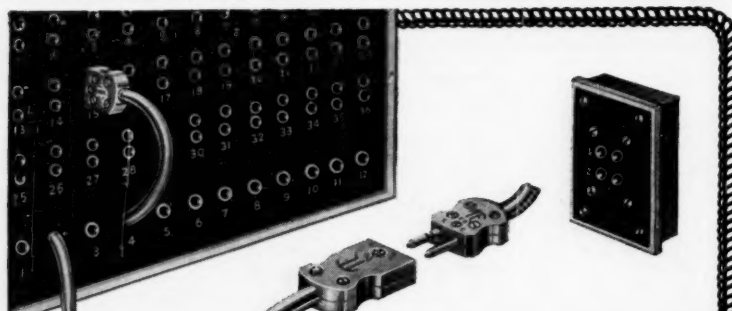
Our Engineering Dept. will be pleased to solve your laboratory planning problems without any cost or obligation on your part. Write today for our literature!

SECTIONAL LABORATORY FURNITURE and EQUIPMENT by

METALAB Equipment Company

310 DUFFY AVE., HICKSVILLE, LONG ISLAND, N. Y.

Our new 180 page Catalog is available upon request on your company letterhead



Transfer Many Thermocouples

With T-E Quick-Coupling Connectors and Panels

Connector Panels T-E has one for your exact needs. These panels provide flexible, centralized control in transferring any number of thermocouples to indicating, multi-point recording and controlling pyrometers. Ideal for patch panel use, they are available in many compact shapes and sizes — with interchangeable plugs and jacks in I-C, C-C, and C-A. A panel for 48 thermocouples and 16 pyrometers measures only 13 1/4" x 7 1/2". Polarity markings and screw-fastened connections make wiring easy.

Quick-Coupling Connectors These connectors permit fast, easy making and breaking of thermocouple circuits. Durable construction guarantees long, dependable usage. Polarized and mechanically interchangeable, all plugs and jacks are of standard provided thermocouple materials. Spring-loaded contacts with long wiping surfaces provide firm but easily broken connections.

Write for Bulletin 23-E.

Thermo Electric Co., Inc.

SADDLE BROOK, NEW JERSEY

In Canada — THERMO ELECTRIC (Canada) Ltd., Brampton, Ont.

READER SERVICE . . .

INDEX OF

Month after month you'll find industry's most progressive firms among our ad pages.

Use this index to keep in touch with what they're offering that'll help you in your job.

Abbe Engineering Co.	244
Aerofin Corporation	216
Aldrich Pump Co.	64
Allied Chemical & Dye Corp.	
General Chemical Div.	77
Nitrogen Div.	97
Solvay Process Div.	95
Allis-Chalmers Mfg. Co.	
General Machinery Div.	127
Aluminum Co. of America	
(Building Div.)	38
Amercoat Corp.	171
American Felt Co.	178
American Flange & Mfg. Co.	125
American Hard Rubber Co.	186-187
American Optical Co.	114
American Pulverizer Co.	238
American Tool & Machine Co.	113
Armco Steel Corp.	115
Atlantic Metal Hose Co.	121
Atlas Mineral Products Co.	248
Aurora Pump Div. of the New York	
Air Brake Co.	237
Babcock & Wilcox Co.	
Tubular Products Div.	132
Bailey Meter Co.	62
Beach-Russ Co.	243
Bethlehem Steel Co.	
Shipbuilding Div.	60
Bird Machine Company	4
Black, Sivalls & Bryson, Inc.	47
Blaw-Knox Co.	
Equip.-Industrial Grating	66
Bowen Engineering, Inc.	249
Bridgeport Brass Co.	93
Buffalo Forge Co.	52
Buffalo Meter Co.	215
Burgess-Manning Co.	239
Cambridge Wire Cloth Co.	206
Carlson, Inc., G. O.	40
Celanese Corp. of America	107
Chemical & Power Products, Inc.	244
Cleaver-Brooks Co.	42, 192
Cole Mfg. Co., R. D.	239
Combustion Engineering Inc.	
Raymond Pulverizer Div.	134
Cooper Alloy Corp.	118
Cooper-Bessemer Corp.	9
Coppus Engineering Co.	57
Corning Glass Works	20-21
Crane Co.	133
Crane Packing Co.	205
Darling Valve & Mfg. Co.	209
Darnell Corp.	241
Davenport Machine & Fndry. Co.	249
Day Company, J. H.	189
Day Company, The	201
Dean Products, Inc.	
Dean Thermo-Panel Coil Div.	252
De Laval Steam Turbine Co.	63
Dempster Bros.	218
Denver Equipment Co.	191
Despatch Oven Co.	238
Devine Mfg. Co., J. P.	251
Dorr-Oliver, Inc.	74-75
Dow Corning Corp.	213
Draco Corp.	58
Ducon Co.	203
du Pont de Nemours & Co. (Inc.)	
E. I. Elastomers Div.	219
Durable Mfg. Co.	202
Duraloy Co.	229
Duriron Company, Inc., The	175
Eclipse Fuel Engineering Co.	183
Eimco Corporation, The	87
Electric Controller & Mfg. Co.	41

ADVERTISERS

Elliott Co.	228
Esso Standard Oil Co.	123
Ever-Tite Coupling Co.	221
Flori Pipe Co.	27
Foster Wheeler Corp.	83
Foxboro Co.	43
French Oil Mill Machinery Co.	241
Fuller Co., The	117
Garlock Packing Co.	31
General American Transportation Corp., Kanigen Div.	56
General Electric Co.	14-15
General Mills Co., Chemical Div.	99
Girdler Co.	Second Cover
Goodrich Industrial Products Co., B. F.	262
Graham Mfg. Co.	199
Graver Tank & Mfg. Co.	122
Great Lakes Carbon Corp. Electrode Div.	68
Grinnell Co., Inc.	36
Grundler Crusher & Pulverizer Co.	252
Hardinge Co.	230
Harris & Co., Arthur	249
Haynes Stellite Company Div. of Union Carbide Corp.	173
Hills-McCanna Co.	212
Hough Co., Frank G.	8
Houston Pipe & Steel, Inc.	27
Illinois Testing Labs, Inc.	243
Independent Engineering Co.	211
Industrial Filter Pumps Mfg. Co.	220
Ingersoll-Rand Co.	89, 130
International Boiler Works Co.	204
International Nickel Co.	124
Jabco Pump Co.	249
Jenkins Bros.	185
Jordan Corp., OPW	248
Joy Manufacturing Co.	7
Kates Co., W. A.	188
Kennedy-Van Saun Mfg. & Engrg. Co.	194
Kidde & Co., Inc., Walter	234
Kinney Mfg. Div. of the New York Air Brake Co.	103
Kirk & Blum Mfg. Co.	208
Klinger Ltd., Richard	180
LaBour Co., Inc., The	24
Lamtex Industries, Inc.	227
Lapp Insulator Co., Pulsafeeder	39
Lawrence Pumps Inc.	232
Leeds & Northrup Co.	26
Link Belt Co.	37
Liquid Carbonic Corp.	50
Magnetrol, Inc.	252
Mallinckrodt Chemical Wks.	59
Manton-Gaulin Mfg. Co.	45
Marley Co.	16-17
Marsh Instrument Co.	247
Master Electric Co., The	Third Cover
McGraw-Hill Book Co.	245
Metallab Equipment Corp.	246
Metallo Gasket Co.	214

Advertising Sales Representatives

Atlanta 3	Robert H. Powell
1301 Rhodes-Haverty Bldg., Jackson 3-6951	
Boston 16	W. D. Boyd
350 Park Square Bldg., Hubbard 2-7160	
Chicago 11	D. Gridley, J. M. Rodger, Jr.
520 N. Michigan Ave., Mohawk 4-5800	
Cleveland 15	L. J. Biel
1310 Hanna Bldg., Superior 1-700	
Dallas 1	E. E. Schirmer
Vaughn Bldg., 1712 Commerce, Riverside 7-5064	
Denver 2	John Patten
1740 Broadway, Alpine 5-2981	
Detroit 26	Chas. M. Crowe, Jr.
856 Penobscot Bldg., Woodward 2-1793	
London EC4	Herbert Lagler
95 Farringdon St.	
Los Angeles 17	John B. Uphoff
1125 W. Sixth St., Madison 6-9351	
New York 36	R. G. Frederick, A. I. Gregory,
John R. Emery	
500 Fifth Ave., Oxford 5-5959	
Philadelphia 3	E. M. Schellenger
Architects Bldg., Rittenhouse 6-0670	
Pittsburgh 22	G. S. Ryan
919 Oliver Bldg., Atlantic 1-4707	
San Francisco 4	W. C. Woolsten
69 Post St., Douglas 2-4600	
St. Louis 6	J. M. Rodger, Jr.
3615 Olive St., Lucas 4867	

New advance in... GAUGE SAFETY

Another Marsh development... new "SAFE-CASE" gauge for those conditions where over-pressures of explosive force can occur.

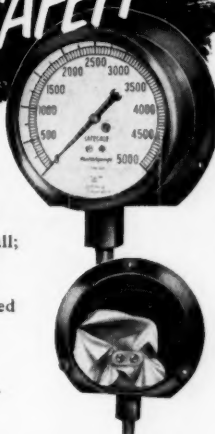
Face well protected by solid metal wall; but, still more important, *entire back* is thin metal plate that opens out to exhaust any abnormal pressure. In testing, heavy blank cartridges, fired within back of case, did not even break crystal.

Use "Safecase" for your toughest services. It is standard in Marsh "Mastergauge"—the highest development in pressure gauges. Ask for facts.

MARSH INSTRUMENT CO.,
Sales affiliate of Jas. P. Marsh Corp.
Dept. 24, Skokie, Ill.
HOUSTON BRANCH PLANT: 1122 Rothwell St.
Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Canada) Ltd.,
8407 103rd St., Edmonton, Alberta, Canada

Test Proves Safety

Explosive force of cartridge merely opens out safety-release back. Back is firmly attached to case and cannot be dislodged during a pressure blow-out.



MARSH GAUGES

Complete rectification
"packages" for operation
of electrolytic cells...



GERMANIUM RECTIFIERS

kw — any rating up to 30,000 Kw
(or higher)

voltage — any rating up to 400
volts (or higher)

efficiency — up to 96%

Literature on request

Rectifier Division

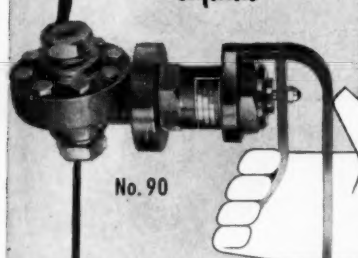
SEL-REX CORPORATION

NUTLEY 10, NEW JERSEY (Offices: Detroit, Chicago, Los Angeles)

OPW-JORDAN

packless, self closing
SAMPLING VALVE

for hazardous
and corrosive
liquids



No. 90

- HOT SOLVENTS
- HOT CAUSTICS
- INFLAMMABLE LIQUIDS

with the sliding gate & plate



the heart of the
OPW-JORDAN
Valve

- LEAKPROOF
- PACKLESS
- EASY-GRIP FLOW CONTROL
- INSTANTANEOUS SELF CLOSURE

The OPW-JORDAN No. 90 Sampling Valve is an outstanding valve, painstakingly engineered for the specific purpose of drawing off hazardous and volatile liquid samples for laboratory test or examination. Easy to operate, the No. 90 provides a convenient, accurate means of sampling liquids without danger to personnel, loss of product or damage to equipment. Durably constructed for hard continuous usage, the basic design and exclusive features of this valve insure outstanding performance and service life.

For more facts, write for Bulletin J-90.
OPW CORPORATION
JORDAN INDUSTRIAL SALES DIVISION



6013 WIENE ROAD
CINCINNATI 13, OHIO
ELmhurst 1-1352

ADVERTISERS . . .

Mueller Corp., H. M.	251
Multi-Metal Wire Cloth Co.	190
Nash Engineering Co.	120
National Filter Media Corp.	236
Neptune Meter Co.	198
Newark Wire Cloth Co.	193
Niagara Blower Co.	237, 252
Norton Co.	29
Norwalk Valve Co.	245
Patterson-Kelly Co., Inc.	72
Pennsylvania Flexible Metallic Tubing Co.	242
Permutit Co.	169
Petro-Chem Development Inc.	111
Pfaudler Co., Div. of Pfaudler Permutit Inc.	Back Cover
Phoenix Mfg. Co.	48
Pittsburgh Corning Corp.	126
Powell Valves, Wm. Powell Co.	167
Protectoseal Co.	44
Pulverizing Machinery Division, Metals Disintegrating Co., Inc.	85
Quaker Oats Company, Chemical Dept.	210
Republic Steel Corp.	18-19
Robins & Meyers, Inc.	61
Roots-Connorsville Blower, Div. of Dresser Industries	109
Ryerson & Sons, Inc., J. T.	136
Saran Lined Pipe Co.	69
Sarco Co., Inc.	165
Sel-Rex Corp.	247
Shell Oil Co.	79
Sinclair Chemicals, Inc.	65
Shriver & Co., T.	231
Smith & Co., Arthur F.	25
Snap-on Tools Corp.	207
Sperry & Co., D. R.	217
Spraying Systems Co.	250
Strahman Valves, Inc.	242
Strong-Scott Mfg. Co.	101
Sturtevant Mill Co.	28
Superior Electric Corp.	55
Surface Combustion Corp.	240
Swenson Evaporator Co.	34-35
Taber Pump Co.	240
Taylor & Co., W. A.	239
Taylor Instrument Co.	10-11, 12-13
Terry Steam Turbine Co.	119
Texas Gulf Sulphur Co.	33
Thermal Research & Engrg. Corp.	235
Thermo Electric Co.	246
Timken Roller Bearing Co.	51
Traylor Engineering & Mfg. Co.	32
United Electric Controls Co.	233
U. S. Gasket Co., Plastics Div. of Garlock Packing Co.	195
U. S. Industrial Chemical Corp. Div. of National Distillers & Chemical Corp.	53-54
U. S. Rubber Co.	177
U. S. Stoneware Co., The	70
Vapor Heating Co.	67
Viking Pump Co.	250
Vogt Machine Co., Henry	163
Wagner Electric Corp.	116
Welding Fittings Corp.	6
Wellington Sears Co.	46
Westinghouse Electric Corp.	22-23
Wheeler Mfg. Co., C. H.	200
Wiegand & Co., Edwin L.	196, 197
Wilfley & Sons, A. R.	49
Williams Patent Crusher & Pulverizer Co.	30
Yarnall-Waring Co.	91
Yuba Consolidated Industries	105

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

PROFESSIONAL SERVICES 253

EMPLOYMENT
OPPORTUNITIES 254, 255

SPECIAL SERVICES 256

EQUIPMENT
(Used or Surplus New)
For Sale 256, 261

WANTED
Equipment 256
Miscellaneous 256

Atlas

INDUSTRIAL FLOORS STOP CORROSION



. . . in pickling
and plating rooms!

Atlas Industrial Floors in your pickling and plating rooms will permanently stop corrosive attack . . . not merely retard or control it. They are resistant to the widest range and concentrations of acids, alkalies, salts and solvents.

These floors are constructed of acid brick laid on an impervious membrane and joined with Atlas corrosion-proof cement. There is a wide choice of cements available . . . each to solve a specific problem.

Atlas floors are engineered to withstand all types of physical abuse from heavy static loads to constant truck traffic.

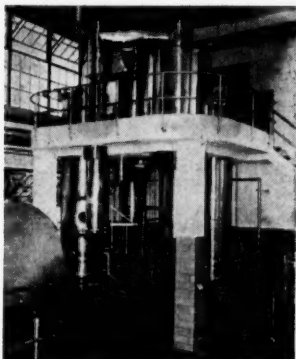
Make an Atlas Floor your permanent corrosion-proof base for operations.

Write for Bulletin 3-3 giving complete details.



MERTZTOWN, PENNSYLVANIA

HARRIS EVAPORATORS Single or Double Effect



Harris Evaporators are built of stainless steel in a wide range of sizes for the Food, Drug, Dairy and Pharmaceutical Industries. They are designed for single effect operation or double effect with or without vapor recompression. Harris Evaporators are constructed for rapid circulation and almost instant evaporation. Manual or fully automatic controls can be provided.

WRITE FOR COMPLETE INFORMATION

ARTHUR HARRIS & CO.
210 North Aberdeen St., Chicago 7, Ill.

Investigate SPRAY DRYING of your Product to:

**Lower its Cost
Improve its Quality**

**BOWEN TEST
FACILITIES ARE
AVAILABLE NOW
AT LOW RATES**

A test run at the Bowen Laboratories can be easily arranged... Telephone RA 5-3232

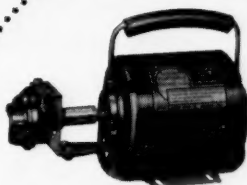
Write for

Illustrated Booklet
"BOWEN TEST FACILITIES"

BOWEN
ENGINEERING, INC.
North Branch 21 New Jersey

cut pumping costs with

JABSCO INDUSTRIAL PUMPS



Model 3600-01
Portable Plastic Pump
and Motor Unit—
316 S.S. Shaft—Carbon
Bearings



PATENTED
AND
PATENTS
PENDING

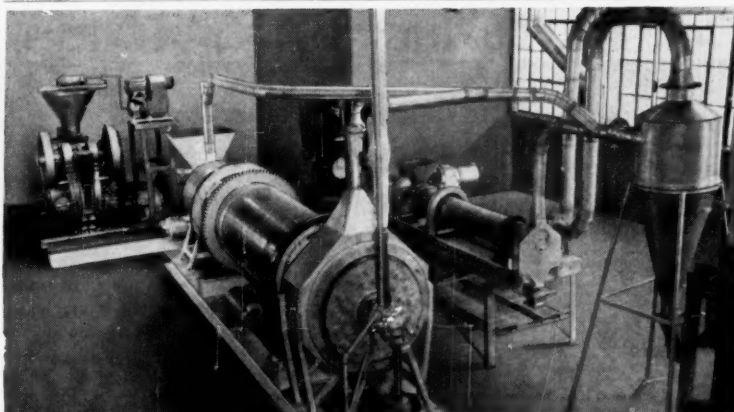
HERE'S another Jabsco industrial pump—designed and built for chemical, pharmaceutical and other industrial applications. Ideal for transfer of various liquids and acids—sump drainage, coolant pumping, general transfer, pulp in solution, filtering, brines, plating solutions—even fluids containing foreign matter or particles, silt, crystals, and other gritty materials. Bronze, stainless steel or plastic construction is available to solve your specific pumping problems.

Pumps either light or heavy viscous liquids. Temperature ranges from 35° to 180° F. Write for a Jabsco factory recommendation for your own needs. Specify application, fluid pumped, temperature, pressure, etc.

FREE—
send for cat-
alog sheets,
detailed
information...
no obligation,
of course!

JABSCO PUMP COMPANY

2031 Lincoln Street, Burbank, California



DAVENPORT

PRESSING — DRYING
and
COOLING Equipment

Continuous DeWatering
Presses

ROTARY DRYERS
Steam Tube, Hot Air
and Direct Fire

Atmospheric
DRUM DRYERS
ROTARY COOLERS
Water and Air

WHAT THIS PILOT PLANT Means to You

This laboratory can pre-determine the advantages of a continuous operation of pressing and drying.

This pilot plant, consisting of a Continuous Mechanical Press, Rotary Steam Tube Dryer and Rotary Fired Dryer, can provide you with the necessary data for determining the economical operation of a commercial size unit for your particular problem.

Let our engineers assist you with your de-watering problems.

Catalog A available of our equipment.

**DAVENPORT MACHINE AND
Foundry Company**
Davenport, Iowa, U.S.A.



Applied Research

to give you better

SPRAY NOZZLES

• Shown above is a portion of Spraying Systems' own research facilities. Here the variables of nozzle design, fluid properties and operating conditions are studied and measured... to provide original data for better design and improved performance wherever spraying is involved.



WRITE FOR Catalog 24... contains forty-eight pages of complete information on thousands of nozzle types and capacities.

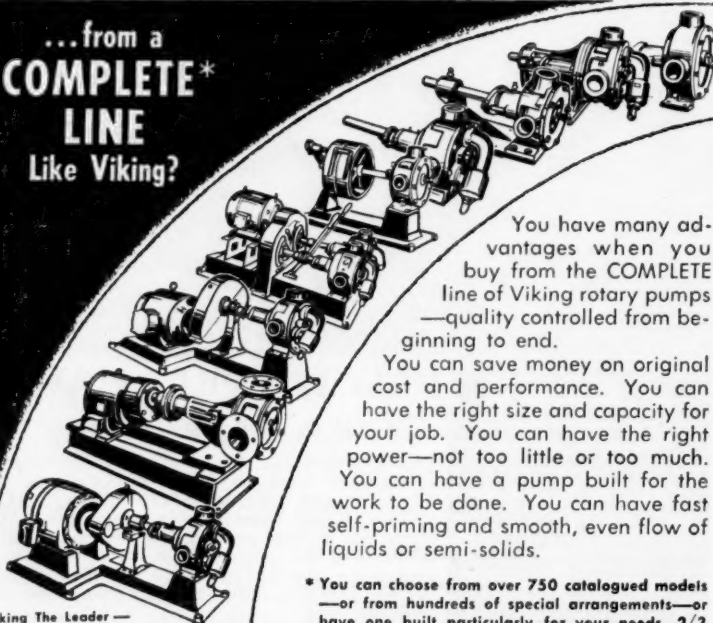


SPRAYING SYSTEMS CO.
3275 RANDOLPH STREET • BELLWOOD, ILL.

ADVANCED SPRAY NOZZLE DESIGN FOR NEW DIMENSIONS IN CONTROL AND PERFORMANCE

ARE YOU BUYING ROTARY PUMPS...

...from a
COMPLETE*
LINE
Like Viking?



Viking The Leader —
Not a Follower in Rotary Pumps

You have many advantages when you buy from the COMPLETE line of Viking rotary pumps —quality controlled from beginning to end.

You can save money on original cost and performance. You can have the right size and capacity for your job. You can have the right power—not too little or too much. You can have a pump built for the work to be done. You can have fast self-priming and smooth, even flow of liquids or semi-solids.

* You can choose from over 750 catalogued models —or from hundreds of special arrangements—or have one built particularly for your needs. 2/3 to 1050 G.P.M. Write today for folder 58SC



VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps
SEE OUR CATALOG IN SWEET'S PLANT ENGINEERS FILE

READER SERVICE...

EDITORIAL

Still available: These highly popular and valuable editorial reprints from past issues of Chemical Engineering. They'll help keep you on top of your profession.

• Processes and Costs

- 48 **Cost Estimation III** — 17 articles, 80 pp. May '54 (\$1.25).
- 52 **Heat Exchanger Design** — Here are useful shortcuts (75¢).
- 56 **Cost Index**—Subject index to 351 cost estimating articles (50¢).
- 65 **Cost Index**—Supplement to above subject index (35¢).
- 69 **Plants & Processes**—Inventory of 1955 (75¢).
- 84 **Plants & Processes**—Reprint from 1956 Inventory Issue (75¢).
- 104 **Thermodynamic Properties of Hydrocarbons**—(50¢).

• Feature Reports

- 4 **Fluid Flow** — Fifteen authoritative articles (\$1).
- 21 **Pumps** — How to select the one you need for your job (50¢).
- 22 **Process Instrumentation** — 48-p. report and 16-p. chart (\$1).
- 25 **Size Reduction** — Updating major pieces of equipment (50¢).
- 26 **Petrochemical Processes**—(50¢).
- 28 **Solids Feeders**—(50¢).
- 33 **Fluidized Solids**—(50¢).
- 36 **Strain Gages**—(50¢).
- 37 **Entrainment Separation** — Equipment and performance (75¢).
- 40 **Process Piping** — Roundup of piping valves, fittings (75¢).
- 46 **Conveyors & Elevators** — Solutions to bulk moving problems (50¢).
- 47 **Mixing** — Understand this universal operation, 48 pp. (75¢).
- 50 **Lubrication** — Of chemical equipment for plant engineers (50¢).
- 54 **Binary Distillation** — Theory and equipment (75¢).
- 55 **Ion Exchange**—A chronicle of remarkable advances (75¢).
- 62 **Solids-Liquids Separation** — Know-how in 1955 (\$1).
- 63 **Solids-Gas Contacting**—Integrated background (50¢).
- 64 **Moving Bed Processes** — Theory and applications (75¢).
- 67 **Solids Concentration** — Survey of techniques (50¢).
- 68 **Bio-oxidation**—Theory, design and practice (50¢).
- 70 **Drying**—Methods, equipment, designs and costs (75¢).
- 73 **Industrial Statistics** — How to use data effectively (75¢).
- 74 **Fermentation**—A total picture of its chemical technology (50¢).
- 76 **Liquid Proportioning**—Equipment, methods and uses (50¢).
- 78 **Inflation** — How to predict the shrinking dollar (50¢).
- 80 **Handling Compressible Fluids**—An over-all view (\$1).
- 82 **Liquid-Gas Contacting**—A practical operation study (75¢).

REPRINTS

- 83 **Mechanical Seals**—How to select and use (50¢).
- 85 **Professional Registration** — Helps for PE-minded CHE's (50¢).
- 86 **Foams in Chemical Technology**—How to use and control (50¢).
- 89 **Nuclear Industry** — And the role of chemical engineers (50¢).
- 91 **High Temperature Technology** — Materials and processes (50¢).
- 92 **To Select Best Pump Seal** — A know-how reprint (50¢).
- 93 **Biochemicals Processing** — The total picture (50¢).
- 95 **Process Control**—The comprehensive June report (\$1).
- 96 **Guide to Process Instrument Elements** — The "hardware" of process instrumentation (50¢).
- 98 **Odor Control**—(50¢).
- 99 **Flowsheets Speed Engineering Communication**—(50¢).
- 102 **Cost Control Systems**. A report—(50¢).
- 105 **Water Conservation**—(50¢).
- 106 **Petrochemical Plant Directory, 1957**—(50¢).
- **Materials of Construction**
 - 35 **Industrial Plastics** — How and where to use (50¢).
 - 38 **Stainless Steels** — Properties and corrosion data (75¢).
 - 79 **Lead Installation** — Best designs for many uses (50¢).
 - 88 **17th Biennial Report** — 34-p. review: protective linings (\$1).
- **CE Refresher Series**
 - 42 **Thermodynamic Principles**—(50¢).
 - 45 **Compression & Expansion**—(50¢).
 - 49 **Chemical Equilibrium**—(50¢).
 - 57 **Homogenous Kinetics**—(50¢).
 - 61 **Catalytic Kinetics**—(50¢).
 - 66 **Interpreting Kinetics**—(50¢).
 - 72 **Simple Reactor Design**—(50¢).
 - 75 **Complex Reactor Design**—(50¢).
 - 81 **Catalytic Reactor Design**—(50¢).
 - 87 **Reactor Design Problems**—(50¢).
 - 90 **Physician Equilibrium I**—(50¢).
 - 97 **Physician Equilibrium II**—(50¢).
 - 100 **Design Reference File**—(75¢).
 - 101 **Fluid Flow Equations**—(50¢).

Order Now:

Use your reader service postcard for the fastest delivery. Pay when billed.

New Series Reprints . . .

The entire series by Max Leva on Flow Through Packings and Beds is available in three reprints:

- 103 **Packed Towers**—(50¢).
- 107 **Fixed and Moving Beds**—(50¢).
- 108 **Fluidized Systems**—(50¢).

Coming . . .

Nine installments of the series on Estimating Engineering Properties by Wallace Gambill now ready:

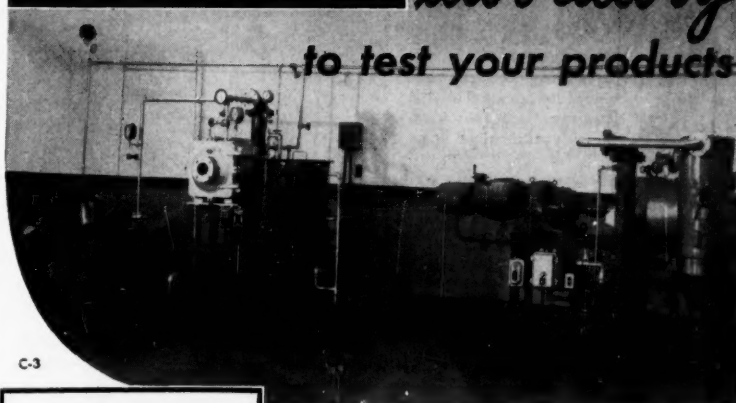
- 94 **Predict Thermal Conductivity**—(50¢).
- 109 **Predict Heat Capacities**—(75¢).
- 111 **Extractive Metallurgy**—(50¢).

Devine

PROCESS EQUIPMENT

PROCESS

laboratory
to test your products



Use DEVINE'S Pilot-Plant Facilities to establish your exact equipment needs:

- ✓ Vacuum Drying
- ✓ Mixing
- ✓ Blending
- ✓ Impregnating
- ✓ Wood Treatment

DEVINE invites you to utilize this process-testing laboratory for advance fact-finding in planning production schedules. Let DEVINE engineers help you to determine the type and size equipment your process requires. Your samples—after testing—will be returned to you with written report for your evaluation.

Write for Details or Phone MUseum 2-5740

J. P. DEVINE MFG. CO.

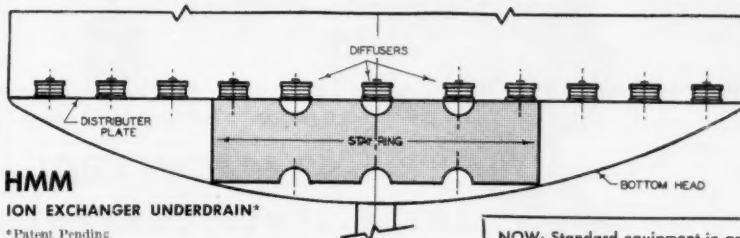
49th Street and A.V.R.R. Pittsburgh 1, Pa.

(One of a series)

Underdrain* SYSTEM of HMM

Water Treating Equipment

USES NO RETAINING BED



HMM

ION EXCHANGER UNDERDRAIN*

*Patent Pending

HMM for years has built into its equipment a fixed underdrain that functions without a supporting bed.

Suitable for use on any type of Ion Exchanger, it eliminates (1) underbed distortion (2) most bed channeling (3) decreases regeneration outage time (4) prevents treated water contamination (5) cuts rinse water consumption.

NOW: Standard equipment in an improved version on all HMM • Deionizers • Cation Exchangers • Anion Exchangers • Softeners

FIELD TESTED & PROVED IN HUNDREDS OF INSTALLATIONS

H. M. MUELLER CORP.

3338 GORHAM AVE., MINNEAPOLIS 26, MINN.

PHONE: WEST 9-6774

Write For Free
Fact-File Folder

"NATURAL WATER IS A RAW MATERIAL; IT SHOULD BE REFINED BEFORE USE."

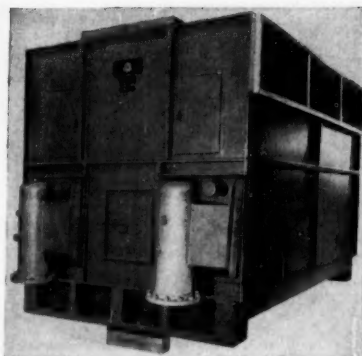
REDUCE OPERATING COST of VACUUM SYSTEMS with this "AERO" (air-cooled) VAPOR CONDENSER

With free air the cooling medium, you use the least water, evaporated in the air stream. You save the cost and pumping of large volumes of condensing water.

Air-vapor subcooling reduces mixture evacuated from the system, saving in the operation of steam ejector or vacuum pump.

This air-cooled condenser gives you more capacity than other types at a substantial saving of steam and power. Water supply, scaling treatment and disposal problems are eliminated.

You get pure condensate, an improved product; often profit by recovery of residues now wasted. There can be no contamination of your product at any time; it never touches raw water. Condensing, of water, of solvents or of your product, is simplified; you have one, compact, easily maintained unit replacing both cooling tower and barometric or surface type condenser.



Niagara Aero Vapor Condenser Panel Casing construction gives access to all parts, saves first costs in shipping and installation.

Maintenance expense is low. Niagara Aero Vapor Condenser Panel Casing construction gives access to all parts, saves first costs in shipping and installation. Summer-winter dampers and Balanced Wet Bulb Control provide precise, year 'round adjustment of capacity to load.

Constant temperature, uniform products and maximum production 12 months a year are assured. Capacities up to 15 million BTU/hr.

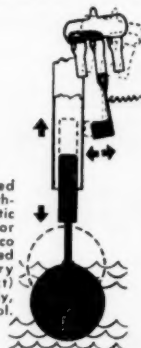
Write for full information. Ask for Bulletin 129R

NIAGARA BLOWER COMPANY

Dept. CE-1, 405 Lexington Ave., New York 17, N.Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

permanent magnetic force...



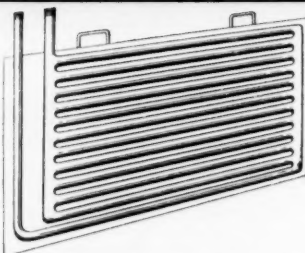
The operating principle

behind **MAGNETROL** LIQUID LEVEL CONTROL

Because its operating principle, based on the proper use of a permanent magnet, guarantees a perpetual guardianship over your critical liquid levels, the Magnetrol liquid level control unobtrusively takes the most important place in any system or process where it is necessary to keep a liquid at a constant level. Principle and action are so simple that failure is virtually impossible. Magnetrol is versatile, too—will handle almost ANY liquid, at ANY temperature, at ANY pressure, with the same precision and dependability. No mechanical or electrical linkages to stick, bind, ride out of line or wear out. Available for controlling level changes from 1/4" to 150 ft. Multi-stage switching when desired. Write to

MAGNETROL, Inc., 2120 S. Marshall Blvd., Chicago 23, Illinois

TELL US YOUR PIPE COIL PROBLEM



Whatever your chemical plant pipe coil problem may be, it is safe to say we will NOT recommend a pipe coil. Pipe coils are out of date. It will usually cost less and you will benefit in every other way by installing a



**DEAN.
THERMO-PANEL
COIL**

Weights less. Uses less space. More efficient. More economical. No electrical hazards. Less time required to install or remove.

ASK FOR Bulletin 355 — 52 pages—Technical Data. Bulletin 257 gives design and price data. And, should you need help, our specialists are always available.



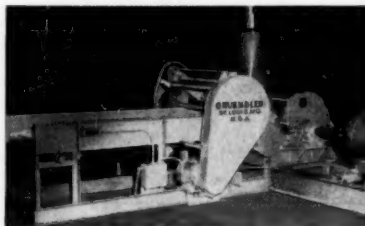
Backed by 20 Years of Panel Coil Manufacturing

DEAN THERMO-PANEL COIL DIVISION
DEAN PRODUCTS, INC., 612 Franklin Ave.
BROOKLYN 38, N. Y. Tel. STerling 9-3400

Manufacturers of Processing Machines Since 1885

Shredders

for PAPER,—PLASTICS,—
ORGANIC FIBRES,—VENEERS



24" x 36" Shredder with feed table in Waste Paper Processing Plant



Part of a week's work — Obsolete correspondence, confidential records, documents, blue prints, brochures and waste paper shredded into fine mass and baled.

BULLETIN #940 mailed on request.

GRUENDLER CRUSHER & PULVERIZER CO.

2915 N. Market St.

St. Louis 6, Mo.

CLASSIFIED . . .

PROFESSIONAL SERVICES

Consult these specialists and let them save you time and money through their specialized skills, wide experience, and detached engineering and economic advice.

The C. W. NOFSINGER COMPANY
*"In Engineering
It's the PEOPLE that Count"*
Engineers and Contractors for the Petroleum
and Chemical Industries
307 East 63rd Street • Kansas City 13, Missouri

JAMES P. O'DONNELL
Consulting Engineer
Chemical and Petro-Chemical Industries
BEAUMONT TEXAS NEW YORK New York

ARIES ASSOCIATES, INC.
Consultants to the Chemical Industries
New Products and Processes
New Product Development
Design & Initial Operation of Complete Plants
Process Analysis—Market Research
COMPLETE TECHNICAL & ECONOMIC SERVICES
77 South St. D.A. 5-2336 Stamford, Conn.

D. Q. KERN ASSOCIATES
Thermal Process Technology
A Supporting Staff of Fifty
Engineers, Designers, Detailers
7016 Euclid Ave., Cleveland 3, O.
52 Wall St. 636 Wyatt Bldg.
New York 5. Washington 5.

**PATCHEN AND ZIMMERMAN
ENGINEERS**
Chemical, Process, and Industrial Plants
Investigations — Reports — Design — Supervision
Augusta, Ga. Atlanta, Ga. Anniston, Ala.

W. L. BADGER and Associates, Inc.
CHEMICAL ENGINEERS
Evaporation, Crystallization and Heat Transfer;
Complete plants for salt and caustic soda; Complete
Dowtherm installations.
300 South State Street Ann Arbor, Mich.

KNOWLES ASSOCIATES
*Chemical—Metallurgical—Mechanical
Engineers*
Consultation — Design
Complete Plants — Equipment
Heavy Chemical—Ore Dressing
19 Hector Street New York 6, New York
Bowling Green 9-3456

PILOT ENGINEERING COMPANY
RESEARCH & DEVELOPMENT
From idea through pilot plant
DESIGN
Process—Equipment—Complete plants
PRODUCTION
Supervision — Trouble shooting
Improvements — By-product recovery
P. O. Box 54 Brooklyn 5, N. Y.

CARTER & NANSEN CO., INC.
DISTILLATION—ABSORPTION
Plants—Process—Equipment
420 Lexington Avenue New York 1, N. Y.

THE KULJIAN CORPORATION
Consultants • Engineers • Constructors
Chemical • Industrial • Process
1200 N. Broad St. Phila. 21, Pa.
Offices Throughout the World

J. E. SIRRINE COMPANY
Engineers
Plant Design & Surveys covering Chemicals, Elec-
trochemical and Metallurgical Production; Trade
Waste Disposal; Water Supply & Treatment;
Analyses & Reports.
Greenville South Carolina

**CORELL AND JONES
ENGINEERS**
Power—Maintenance
Chlorine—Soda Ash—Perchloroethylene
Pigments and Related Products
Design—Reports—Operation
413 Rose Blvd. Tels: Akron, O. TR 84271
Akron, Ohio Wadsworth, O. FE 56542

**R. B. MACMULLIN
ASSOCIATES**
Chemical and Electrochemical Plants
Complete Process and Project Engineering
Research Guidance Economic Surveys
610 Hancock Bldg. Niagara Falls, N. Y.

**THE J. G. WHITE
ENGINEERING CORPORATION**
Design - Construction - Reports - Appraisals
80 Broad Street, New York 4

CARL DEMRICK
Technical Translations
Send for Circular
53 So. Broadway Yonkers, N. Y.

CHAS. T. MAIN, INC.
Engineers
Industrial Plants
Reports Design Construction Supervision
80 Federal Street Boston 10, Mass.
317 So. Tryon Street Charlotte, North Carolina

THE REAL VALUE
of placing your unusual problem in the
hands of a competent consultant is that
it eliminates the elements of chance and
uncertainty from the problem and provides
real facts upon which to base decisions.

"By reason of special training, wide experience and tested ability, coupled with professional integrity, the consulting engineer brings to his client detached engineering and economic advice that rise above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he cost him."

CLASSIFIED . . .

EMPLOYMENT OPPORTUNITIES

CE's nation-wide coverage brings you each month tips and information on current opportunities in job functions throughout the chemical process industries.

► **Coverage** — National, Executive, management, engineering, technical, sales, office, skilled. Positions vacant, positions wanted, civil service, selling opportunities, employment agencies and services, labor bureaus.
► **Displayed Rates**—\$46 per inch for all ads except on a contract basis: contract rates on request. An advertising inch is measured $\frac{1}{4}$ in. vertically on a column; 3 columns, 30 in. per page. Subject to the usual agency commission.

► **Undisplayed Rates**—\$2.10 per line, 3 lines minimum. To figure advance payment count 5 average words as a line; box number counts as 1 line. 10% discount if full payment is made in advance for 4 consecutive insertions. Not subject to agency commission.

► **Closing Date**—January 27th issue closes January 6th. Send new ads to Chemical Engineering, P. O. Box 12, New York 36, N. Y.

SALES ENGINEER

New opening with established manufacturer of inert gas generators and dehydrators for graduate engineer with minimum 5 years sales and application experience in this field.

Salary to \$10,000. Fee Paid.

FIDELITY PERSONNEL SERVICE

1218 Chestnut St., Philadelphia 7, Penna.

CHEMICAL ENGINEERS METALLURGISTS

Staffing new plant. Need urgently engineers with experience in high energy fuels or nuclear power. Company located in the vacationland of the country. Client assumes all employment expenses. Contact in confidence.

MONARCH PERSONNEL

28 E. Jackson Blvd. Chicago 4, Illinois

REPLIES (Box No.): Address to office nearest you
c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (1)
LOS ANGELES: 1125 W. 6th St. (17)

POSITION VACANT

Instrument Maintenance—Engineer or technician with experience in maintenance of electronic and pneumatic instruments used in chemical processes. B. S. degree in EE or Mech. Eng. or equivalent. Abbott Laboratories, Employment Division, North Chicago, Illinois.

Chemical Engineers: 0 to 5 years experience. interested in laboratory research and pilot plant processes for sulfur recovery and extractive metallurgy. Considerable travel for one or more years. Publication privileges and liberal employee benefits with salary commensurate with experience. Send details to Professional Relations Office, Mellon Institute, Pittsburgh 13, Pennsylvania.

Chemists Engineers — Bi-lingual. Russian. German, French as free lance translators & Editors. Write Box CE 450, 125 W. 41 St., NYC.

EMPLOYMENT SERVICES

Salaries Personnel \$5,000-\$35,000. This Confidential service established 1920. Is geared to needs of high grade men who seek a change of connection, under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, P.O. Box 674, Manchester, Vermont.

EMPLOYMENT SERVICES

Better Positions—\$6000 to \$50,000. Want a substantial salary increase, more opportunity or different location? This national 47 year old service connects you with best openings. You pay us only nominal fee for negotiations: this we refund when employer pays placement fee. Present position protected. In complete confidence, write for particulars. R. W. Bixby, Inc., 553 Brisbane Bldg., Buffalo 3, N. Y.

SELLING OPPORTUNITY OFFERED

Opportunity for manufacturers rep. sell mixing machinery to chemical, ink, paint industries. Several territories available. Your inquiry should outline sales background, present representation, and data you feel will help in our selection. RW-6832, Chemical Engineering.

POSITIONS WANTED

Creative midwest mechanical engineer with M.S. in Bus. Adm. desires to relocate in mild climate. Age 40, income \$9500, married, three children, present position head of product development section of main plant of multiplant corporation. Fourteen years experience in testing, design, development and field trouble shooting of drying process equipment in chemical, food & textile industries. PW 6849, Chemical Engineering.

ChE 16 yrs.: evaluation, process design, process development, planning, coordination— liquid fuels, aluminum, chemicals. Desires West Coast. PW-6725, Chemical Engineering.



PIPING & PRESSURE VESSELS DESIGNER, ALL TYPES OF WELDS, A.S.M.E. & A.S.T.M. CODES. ACCEPTS ASSIGNMENTS. ALSO, TO FIELD PIPE LINES & MOUNTINGS (EQUIPMENTS, BOILERS, ETC.)

SALVATORE FOLLARI
PW-6794—Chemical Engineering
Class. Adv. Div., P.O. Box 12,
N. Y. 36, N. Y.

Don't forget THE BOX NUMBER

when answering the classified advertisements in this magazine. It's our only means of identifying the advertisement you are answering.

PAINTING ENGINEER

Opportunity for career employment in staff department of multi-plant fabricator of durable steel products. Employment in Kansas City, Missouri.

Advancement by merit; complete benefit program; attractive compensation plan. Company-paid retirement.

We visualize successful applicant as having completed work for chemical engineering or mechanical engineering degree, with 3 to 5 years practical experience in problems connected with metal painting and coating. This is a top opportunity for a capable, qualified engineer who wants to use fully his coatings and engineering training and experience.

Send full particulars in confidential letter to Orval W. Groves, Employment Supervisor at address shown below.

BUTLER MANUFACTURING CO.

7400 East 13th Street
Kansas City 26, Missouri

26

ISSUES
A YEAR
TO REACH
THE CHEMICAL
PROCESSING
INDUSTRIES

That's

**Chemical Engineering's
New
Publishing Schedule
For 1958**

As a "Searchlight" Advertiser you make more calls, more frequently with more impact!

TECHNICAL NEWS EDITOR

Opening on Chemical Engineering's editorial staff for a young engineer to develop and write technical news on chemical processes, methods, plants, products and equipment. Unusual opportunity to broaden contacts, education and experience. Requirements: Degree in chemical engineering; up to three years industry experience; ability to evaluate technical information; able to write clearly and accurately; ability to work well with people, initiative and imagination. New York City location. Send resume and salary requirements to:

John R. Callahan, Editor-in-Chief
Chemical Engineering
330 West 42nd Street
New York 36, N. Y.

CHEMICAL ENGINEER URETHANE

National organization with excellent benefits, hospitalization, insurance, retirement fund, etc., needs chemical engineer, preferably, or chemist, to manage and direct the development of polyurethane foam applications and manufacturing processes for company's products. Must supervise well-equipped laboratory and laboratory personnel. Experience required in polyurethane in addition to knowledge of latex, vinyl foam, plastics, rubber technology. Must have mechanical comprehension to be able to initiate proper machine design and proven ability to initiative, creativeness, and technical supervision. State salary requirements. Send resume to

P-6714, Chemical Engineering.
Class. Adv. Div., P. O. Box 12, N. Y. 36, N. Y.

Process Development and Design Engineers

A few high caliber chemical, petroleum or mechanical engineers needed immediately for development and design of production-scale processes and equipment involved in the manufacture of:

Plastics monomers in our rapidly expanding Texas City, Texas plant.

Polymers at our plastics division headquarters, Springfield, Mass.

REQUIREMENTS: B.S. or M.S. in chemical petroleum or mechanical engineering with above average grades. 1 to 5 years relevant experience.

Please send resume to:
Mr. J. M. Kemp
Technical Recruiting Section

MONSANTO
CHEMICAL CO.
SPRINGFIELD 2, MASS.

PROJECT ENGINEERING COORDINATOR

Midwest Chemical company desires to hire graduate chemical engineer with broad experience in project, design and process engineering in the petrochemical field. Must have ability and experience in supervision and coordination of project activities including personnel involved.

Please send detailed resume of personal data, experience, education, and present salary to

P-6791, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

ENGINEERING SALES positions in PROCESS CONTROL INSTRUMENTATION - field or home office -

Interested in a sales engineering career in the field of instrumentation and automation? We are looking for qualified engineering graduates, preferably electrical, chemical, or mechanical, between 25 and 35 years of age, with a few years' experience in instrumentation, engineering sales, or industrial processing.

Field locations are in U.S. industrial areas. Home office openings are for sales specialization in electrical instrumentation; or for sales specialization in petroleum, chemical, or metals industry.

Sales aptitude tests given at our expense, plus thorough training course at home office (Foxboro, Mass.) for successful applicants.

If you feel you are qualified for a permanent sales engineering position in this expanding industry, please write (giving outline of education and experience) to

The Foxboro Company, Foxboro, Massachusetts.

FOXBORO

Reg. U.S. Pat. Off.

GALLERY CHEMICAL CO. Pioneer in High Energy Fuels and Boron Chemistry has openings for:

INSTRUMENTATION ENGINEERS

For Development Activities

Graduate Engineer. Minimum 3 years' industrial chemical plant or petroleum refining experience. For the application and/or modification of analytical instruments for use on process plant streams.

INDUSTRIAL APPLICATION ACTIVITIES

Graduate Engineer. Minimum 3 years' experience in specification writing, selection and application of industrial automatic control equipment to process plant streams. Will consider non-graduate with minimum of 5 years' applicable experience. Permanent positions.

Positions for maintenance supervisors also open.

Send Resume to
Personnel Manager

GALLERY CHEMICAL CO.
Callery, Pa.

CHEMICAL and MECHANICAL ENGINEERS

A large and expanding international petroleum company has openings for several Chemical and Mechanical Engineers with outstanding ability. This is a challenging opportunity to share the responsibility of coordinating international refining operations. Excellent advancement opportunities for applicants with a minimum of 3 years petroleum or chemical industry experience. Immediate assignment to our Far East refineries or to our White Plains Headquarters with an eventual overseas assignment. Salary commensurate with experience, liberal annuity, insurance, hospitalization and savings plans. Will pay moving and transportation expense. Please send resume to:

DENNIS V. WARD
STANDARD-VACUUM OIL COMPANY
P. O. BOX 100Q
WHITE PLAINS, N. Y.

CLASSIFIED . . .

EQUIPMENT SEARCHLIGHT

CE's Searchlight spots the big bargains in used, resale and rental equipment. Check this issue's listings—most complete in the field—for items you need now.

► **Coverage**—National (see index of advertisers in this section for your nearest dealer). Equipment and facilities—used, resale and rental—for the process industries. For sale, wanted, for rent.
► **Rates**—\$21.75 per inch for all ads except on a contract basis; contract rates on request. An ad-

vertising inch is measured $\frac{1}{4}$ in. vertically on a column; 3 columns, 30 in. per page. Ads acceptable only in display style.

► **Closing Date**—January 27th issue closes January 6th. Send all new ads to Chemical Engineering, Classified Adv. Division, P. O. Box 12, New York 36, N. Y.

COORDINATED RESEARCH
NDI
NEW DRUG INSTITUTE
TOXICITY TESTS
following FDA procedures, for chemicals, foods, drugs, cosmetics, pesticides, additives. Biological assays. Screening tests. Complete research and development services. No obligation for estimates. Call or write Arthur D. Herrick, Director.
NEW DRUG INSTITUTE
120 East 59 St., New York 22 • MU 8-0640

CRUSHERS, JAW $2\frac{1}{2}$ x 6 (Lab), 9 x 15 Climax, 13 x 24 Traylor, 24 x 13 Farrel, 36 x 10 Farrel
CRUSHERS, ROLL 16 x 10 Sturtevant, 30 x 16 Chambers, 24 x 24 LB & 30 x 30 Jeffrey single
MILLS, HAMMER $7\frac{1}{2}$ HP Straub, 25 HP Wms. AKB, 50, 100, 150 HP Jeffrey
MILLS, BALL 3' x 8", 8' x 36", 8' x 48" Hardinge, Conical, New linings 5' x 20", 6 $\frac{1}{2}$ ' 21/Tube 4' x 8' Rod (50 HP)
SCREENS 40" x 84", Roball, 40" x 120" Rotex, 3' x 5' 3' x 10', 4' x 10' Tyler Hummer, 42" x 10' Cedar Rapids, 4' x 10' Deister, 5' x 12' Hewitt Robins
MIXERS, Lab double cone, 16 cu. ft. twin shell P.K. 5 cu. ft. EBB & EAG 3 & EAG 4 Lancaster.
ROTARY DRYERS 24" x 20', 44" x 25', 60" x 40', (60" x 45') 80" x 60' with auto. controls & dust collectors
BEATERS Syntrol Sil, F21, F33—Jeffries 2A Vibrating—30" x 30", 40" x 8' Apron
EXHAUSTERS 2500—4000—9000—11000—21000—36000—CFM American, Buffalo, Clarage & Sturtevant
FORK LIFT TRUCK 2000# cap.—Hyster—12 ft. lift. Pneumatic tires

Start the New Year right—Take Your Family to Your Church

LAWLER COMPANY

Durham Ave. Liberty 9-0245 Metuchen, N. J.

GOOD USED MACHINERY FOR SALE

Dryers, Kilns, Centrifugals, Filters, Kettles, Tanks, Grinders, Crushers, Mixers, Screens, Tablet Machines, Hydraulic, Plastic and Rubber Machinery, etc. Send for bulletins.

STEIN EQUIPMENT CO.

107—8TH STREET BROOKLYN 15, N. Y.
Sterling 8-1944

FOR SALE

BAKER PERKINS HEAVY DUTY JACKETED 200 GAL. SIGMA BLADE MIXER

EXCELLENT CONDITION

THIEM PRODUCTS, INC.

9800 W. Rogers St., Milwaukee 19, Wisconsin

SELL VALVES BUY

Gates Globes Angles Plugs
Stainless—Cast Iron—Steel—Bronze
All Sizes & Pressures
Surplus—New—Reconditioned
We Buy Surplus Inventories
NEW or USED

CHARLES A. WOLF

7612 Atlantic Ave., Bell, California
Ludlow 7-6363 Ludlow 7-1824

WE NEED

All Kinds of Oil Refinery and Chemical Equipment, also Tanks
Write — Wire — Phone

Weinstein Co., Div. of Web-Jamestown Corporation, Inc.
610 West 8th Street Jamestown, New York

EQUIPMENT WANTED

Girdler or Similar Unit

To manufacture Hydrogen from Methane complete with Reformer Furnace less compressor. Capacity: 700,000 to 1,000,000 SCFD. State age, condition, price F.O.B. location.

P. O. BOX 8157 HOUSTON, TEXAS

WANTED

PILOT PLANT EQUIPMENT

1—Tray dryer, explosion-proof, steam heated, about 120 square feet, with or without controls.

1—Batch centrifugal, explosion-proof, perforated basket, bottom driven, cake capacity about one cubic foot.

C. A. Padgett

MARBON CHEMICAL

Division of Borg Warner

P.O. Box 68, Washington, West Virginia

EQUIPMENT SEARCHLIGHT ADVERTISER'S INDEX

American Air Compressor Corp.	259
Barcan Co., Irving	258
Brill Equipment Co.	257
Campbell Sons' Corp., Harry T.	257
Cities Service Oil Co.	260
Consolidated Products Co.	257
Dougherty, J. A.	259, 260
Equipment Clearing House Inc.	260
First Machinery Corp.	259
Foster Co., L. B.	260
Gelb & Sons Inc., R.	261
Heat & Power Co., Inc.	259
Lawler Co.	256
Loeb Equipment Supply Co.	259
Johnson Machinery Co.	260
Machinery & Equipment Co.	257
Machinery & Equipment Corp., The	260
Machinery & Steel Div.	
United Iron & Metal Co.	258
Margon Chemical Div. of	
Borg-Warner Corp.	256
Meyer & Sons, Inc., Wm. M.	258
New Drug Institute	256
Perry Equipment Corp.	258
Preferred Electric Motors, Inc.	257
Stanhope Inc., R. C.	260
Stein Equipment Co.	256
Theim Products Inc.	256
Union Standard Equipment Co.	258
Universal Machinery & Equipment Co.	259, 260
Warren Development Corp., The	256
Weinstein Co.	260
Wolf Co., Charles A.	256

FOR RATES OR INFORMATION

About Classified Advertising

Contact

THE MCGRAW-HILL OFFICE
NEAREST YOU

ATLANTA, 3	1301 Rhodes-Haverty Bldg. Jackson 3-6951	R. POWELL
BOSTON, 16	350 Park Square	HUBbard 2-7160
		J. WARTH
CHICAGO, 11	520 No. Michigan Ave.	MOhawk 4-5800
		W. HIGGINS
CINCINNATI, 37	2005 Seymour Ave.	ELmhurst 1-4150
		F. ROBERTS
CLEVELAND, 13	1164 Illuminating Bldg.	SUperior 1-7000
		W. SULLIVAN
DALLAS, 1	901 Vaughn Bldg.	RIverside 7-5117
		G. MILLER
DETROIT, 26	856 Penobscot Bldg.	WOodward 2-1793
		J. GRANT
LOS ANGELES, 17	1125 W. 6 St.	MAdison 6-9351
		R. YOCOM
NEW YORK, 36	500 5th Ave.	OXford 5-5959
		R. LAWLESS
		R. OBENOUR
		D. COSTER
PHILADELPHIA, 3	17 & Sansom Sts.	RIffenhouse 6-0670
		H. BOZARTH
		H. EDSALL
ST. LOUIS, 8	3615 Olive St.	JEfferson 5-4867
		F. HOLLAND
SAN FRANCISCO, 4	68 Post St.	DOuglas 2-4600
		W. WOOLSTON

GO WEST FOR THE BEST

- ★ 2-6' x 45' Louisville Flame Dryers
- ★ 2-6' x 50' Louisville Rot. Steam Dryers
- ★ 5-4'x30' Baird Dryers, Mtrs & drives
- ★ 1-Proctor-Schwartz 8' x 50' Apron Dryer
- ★ 1-42" x 90" Double Drum Dryer, Buffalo
- ★ 2-Link-Belt Roto-Louvre Dryers, 207-10, 310-16
- ★ 1-Kemarek-Greaves 15 TPH Briquetting Press
- ★ 2-Sharples D-2 type 316 S.S. Filters
- ★ 2-Sharples C-27 Super-D-Hydrators, S.S.
- ★ 2-A T & M 42" susp. perf. basket Centrifuge
- ★ 1-Sharples PN-14 Super-D-Cantor, 15 HP
- ★ 1-Elmco 8' x 8' Rot. Cont. Filter, Complete
- ★ 1-Sweetland #2 Filter, 9 bot lvs 4" centers
- ★ 1-Oliver 8' x 10' Cont. Vacuum Precoat Filter
- ★ 1-Day 14" x 30" High Speed Paint Mill
- ★ 1-Lehman 18 1/2" x 39 1/2" High Speed Mill
- ★ 1-Raymond 3 Roller High Side, Cone Separator
- ★ 1-Williams 4 Roll High Side Whizzer Separ.
- ★ 1-Fitzpatrick Model K Comminuting machine
- ★ 14-Syntro Spiral Vib. Elevators, 8'6" lift
- ★ 4-Jeffrey Vib. Conveyors, #3MC-8", 9' long
- ★ 2-Rietz RD-18 Disintegrators, 75 HP motors
- ★ 8-Lightnin Model SEV side enter Agitators
- ★ 1-Readco 25 gal dbl arm Sigma Jektd Mixers
- ★ 1-Baker-Perkins sigma Mixer, 33 x 37 1/2 x 30"
- ★ 1-Sturtevant 1 1/2 ton Mixer, 75 cu ft batch
- ★ 111" dia x 15 Stainless steel Tank
- ★ 8-5'6" x 30' Pressure Tanks, 3000 W.P.
- ★ PACKAGING EQUIPMENT—Filters, Coppers, Casers, Labelers. Many sizes, type. Send inquiry.

GOOD USED EQUIPMENT

MACHINERY AND EQUIPMENT COMPANY

214 Bryant Street • San Francisco 7, Calif.

FOR SALE

S.S. CONTINUOUS FILTERS: 1—30" x 40" solid bowl, tapered; 1—30" screen type, Laughlin design, bronze basket; 1—21" solid bowl, tapered; 1—7" Lab. size solid bowl, tapered; 2—Lab. size, screen type.

SWEETLAND FILTER: 1—No. 12, on 2" C.C., 72 bronze leaves.

SPERRY FILTER PRESSES: 5—18" x 18" cast iron, pl. & fr., closed del. 11 chambers.

CONSOLIDATED PRODUCTS CO., INC.
154 Observer Highway Hoboken, N. J.
BA 7-0600 OL 9-4425

FOR SALE

- 1—Patterson 7 x 18"—Two Compartment Ball Mill—practically new—spare liners, spare gears—400 HP motor and reducer
- 1—Atlas 5' Dia—22'6" long Ball Mill—Stone lining
- 1—Schmidt 5'6" Dia—21' long Ball Mill—Stone lining
- 1—25B TelSmith Gyrotory Crusher
- 4—F. J. Mack Dumps—rock bodies
- 1—Used Northwest Shovel—Model 80D—2 1/2 yd.
- 1—New Northwest Shovel—Model 80D—2 1/2 yd.
- 1—Generator—156KVA—240 volt 3 phase 60 cycle Murphy diesel—on rubber tires

HARRY T. CAMPBELL SONS' CORP.
Campbell Building Towson 4, Maryland
Phone — Valley 3-7000

**MOTORS • GENERATORS
TRANSFORMERS • M-G SETS • CONTROLS**
New • Rebuilt • Bought • Sold

PREFERRED Electric Motors Inc.

P.O. Box 767, Rochester 3, N.Y. Ph. HA 6-3420

TO HELP YOU . . .
find equipment you need

"Searchlight" Advertising



you can't beat BRILL FOR VALUE

CENTRIFUGALS

- 4—Bird 32"x50" solid bowl Continuous Centrifuges 316 S.S. fume-tight, 60 HP TEFC motors, NEW 1953.
- 2—Bird 36"x50", 18"x28" steel, solid bowl, continuous.
- 2—Bird 24"x38", 18"x28", 304 S.S. Solid Bowl, continuous.
- 1—Sharples PY-14 Super-D-Cantor, 304 S.S.
- 2—Bird 40" suspended, 347 S.S.
- 1—Bird 40" suspended, rubber.
- 3—Tolhurst 40", 32", 26", suspended.
- 1—AT&M 40" suspended, steel.
- 1—AT&M 36" centralising, rubber covered, perforated basket.
- 1—Tolhurst 32" Suspended, 304 S.S.

HEAT EXCHANGERS

- 1—1220 sq. ft. 304 S.S. tubes, 150 psi.
- 1—1050 sq. ft. 304 S.S. tubes, 75 psi.
- 1—947 sq. ft. 304 S.S. tubes, 60 psi.
- 1—786 sq. ft. 304 S.S. tubes, 60 psi.
- 1—570 sq. ft. 304 S.S. tubes, 60 psi.
- 1—336 sq. ft. 304 S.S. tubes, 150 psi.
- 1—315 sq. ft. 316 S.S. tubes, 250 psi.
- 1—250 sq. ft. 316 S.S. tubes, 900 psi.
- 20—16, 20, 28, 48 & 68 sq. ft. 316 S.S. tubes.
- 7—Karbate 24.6 sq. ft. tubular.

MIXERS

- 1—Baker Perkins #15USE, ALL STAINLESS double arm, jacketed, Vacuum.
- 1—Baker Perkins #15VUMM, 100 gal. jacketed, 100 HP.
- 1—Baker Perkins No. 16 TRM 150 gal. jacketed, sigma blades, Vacuum.
- 1—Baker Perkins 50 gal. jacketed, Sigma blades.
- 5—Day "Cincinnati" double arm 250 and 100 gals.
- 5—Steel Powder 50, 225 and 350 cu. ft.
- 1—10 cu. ft. "V" Blender, 304 S.S.
- 1—Eppenbach 1 HP, 304 S.S. Homo Mixer.

DRYERS

- 3—Bartlett & Snow 7'x30", 6'x30" Rotary.
- 1—H & B 5'x30" direct heat Rotary.
- 3—Link Belt Roto Louvre 5'2"x20", 6'4"x24", 7'5"x25".
- 4—Devine double door Vacuum Shelf 17 and 20—59"x78" shelves.
- 1—Devine single door Vacuum Shelf 20—40"x43" shelves.
- 8—Stokes single door Vacuum Shelf 4, and 8—24"x36" shelves.
- 3—Louisville Steam Tube 6'x50", 38"x25".
- 2—Bailovak 5'x12" Atmos. single drum.
- 2—Devine 4'x9" Atmospheric single drum.
- 2—Tray Dryers, steam heated, 95 sq. ft.

MISCELLANEOUS

- 3—25 Ton Freon Refrigerating Units.
- 7—Stokes DD2, D3, D3, B2, "R" & "F" Tablet Presses.
- 8—Nash Vacuum Pumps H10, H9, H6, H5, L5, TS7, #4.
- 10—Rotex Robinson Tyler Hummer Screens single and multiple deck.
- 8—Wilfley 4" Hoveg lined Centrifugal Pumps, motor driven.
- 15—Chlorimet, Durimet & Duriron Centrifugal Pumps 1 1/2" to 5".

REACTORS, COLUMNS, TANKS

- 1—Nooter 1000 gal. nickel-clad, jacketed, agitated Reactor.
- 2—Pfauddler 250 gal. glass lined, jacketed, agitated Reactors.
- 1—Pfauddler 100 gal. S.S., jacketed, agitated, Reactor, XP motor.
- 3—Pfauddler 500 and 300 gal. glass lined, jacketed Reactors.
- 1—600 gal., 316 S.S. jacketed, agitated Reactor 200# internal pressure, 75#.
- 1—3500 gal. 304 S.S. jacketed, agitated.
- 1—Wyatt 24" dia. x 42", 304 S.S. Bubble Cap Column.
- 1—10,000 Aluminum Storage Tank 10'x16'x 1 1/2" shell, 25# W. P.
- 4—1,000 gal. S.S. Clad, Vertical Tanks.
- 1—56" dia. x 16' long, 304 S.S. Horizontal tank, 3000 gals.
- 3—Steel Storage Tanks 8 1/2'x25', 8'x16', 6'x20".

LIQUIDATION TRENTON CHEMICAL COMPANY TRENTON, MICHIGAN

Main Items

- 1—Swenson Quadruple Effect Evaporator, 12,975 sq. ft.
- 1—Arnold 6' dia. 304 S.S. Evaporator, 325 sq. ft.
- 1—Harris 3' dia. 304 S.S. Evaporator with steam coils.
- 3—American 42"x120" Double Drum Dryers 10 HP motors.
- 3—Louisville 6'x50" Rotary Steam Tube Dryers, reducer and 20 HP motor.
- 1—Bird 36"x50" Steel, Solid Bowl, Continuous Centrifuge.
- 1—Bird 40" suspended, rubber covered, perforated basket, Centrifuge.
- 2—AT&M 42" suspended, Stainless Steel, perforated basket, Centrifuge.
- 2—Tolhurst 40" suspended, steel, perforated Centrifuge.
- 1—2000 gal. 304 S.S. vertical, agitated, jacketed Tank.
- 1—5500 gal. rubber lined 10'x3' vertical Tank.
- 1—10,000 Aluminum 10'x16' horizontal Tank.

Write or Phone for Detailed Circular

Representative on Premises for inspection — Harrison & Superior Aves.
Trenton, Mich. Tel: Orleans 6-5110

BRILL EQUIPMENT COMPANY

2401 THIRD AVE., NEW YORK 51, N. Y.
Tel. CYpress 2-5703 • Cable: Bristen, N. Y.

TEXAS OFFICE—4101 San Jacinto St., Houston 4, Texas—Tel. Jackson 6-1351

IN STOCK

Phila. Gear agitator drives, 60 HP, 11.66:1 ratio

Bird 32" x 50" continuous centrifugals, T316 SS, fume tite

Bird 24" x 24" continuous centrifugals, slotted screen, monel

Bird 24" x 38" continuous centrifugals, steel, 1953

Sharples C-20 Super-D-Hydrator, T316 SS

Sharples C-27 Super-D-Hydrators, T316 SS or monel

Copper bubble or tunnel cap columns: 24", 36", 42", 48" dia., up to 59 plates

Bufflovak 42" x 120" double drum dryers (2) with 125# drums, (1) with 160# drums

American 36" x 84" double drum dryer, VACUUM

UNUSED Bufflovak 5' x 12' single drum dryer, VACUUM

Andersen SS vacuum shelf dryers, 108 sq. ft., six individual chambers 1070 sq. ft. shell & tube exchangers, T304 SS, ASME 150#

910 sq. ft. shell & tube exchanger, admiralty tubes, ASME 75#

9' x 30' rotary dryer, SS lined

Beird 4' x 30' rotary dryers

Taylor-Harmor 4' x 30' rotary dryer, double shell

Louisville 6' x 45' rotary steam tube dryer

Nickel-Clad vert. long tube evaporators, 400 & 250 sq. ft.

Bufflovak vert. long tube dbl. effect evaporator, 588 sq. ft., S.S.

Niagara #510-28 pressure leaf filter, T316 SS

Sparkler #33-5-28 pressure leaf filters, 151 sq. ft., T304 SS

Sweetland filters: #12, #7, #5

Eimco 10' D x 12' F rotary vacuum filters, rubber covered

Hardinge 10' x 96" conical mills

Allis-Chalmers compeb mill, 7' x 24', 450 HP

Raymond #15—6 roll low-side mill, 200 HP

UNUSED Patterson 5' x 22" ball tube mill, 200 HP

H. K. Porter pebble mills, 6' x 5', stone lined

Baker-Perkins #15-USE dispersion blade, double arm mixer, SS, 100 gal; 75 HP

Davenport #1A Dewatering Presses NEW 10,500 gallon horiz. SS tanks

3000 gal. SS tank trailers

FOR MORE IN STOCK
VALUES, Send For List #158

PERRY EQUIPMENT CORPORATION

1413-21 N. SIXTH STREET
PHILADELPHIA 22, PENNA.

Poplar 3-3505

N. Y. C. Phone: Oxford 7-8685

For Sale!

RUBBER LINED TANKS

42' 1. x 9'6" dia.
21'6" 1. x 10'6" dia.

MOTOR DRIVEN PUMPS

Stainless Steel, Duriron, Rubber Lined, Monel, Iron. Centrifugal, Gear, Steam Jacket and Impeller Types.

SPENCER TURBINE BLOWERS

Various Sizes

INFILCO WATER PURIFICATION UNIT & PUMPING STATION**NEW DURIRON PIPE & FITTINGS****MACHINERY & STEEL DIV.**

United Iron & Metal Co.

2545 Wilkens Ave.

Baltimore 23, Maryland

Phone: Gilmor 5-5600

Premier 6" and 10" COLLOID MILLS
Abbe 1½ gal. and 200 gal. DISPERSAL MIXERS

Sharples type M-12-161 H CENTRIFUGE
Patterson Gyro-Centric Screen, complete.

STAINLESS STEEL jacketed kettles 100 gal. and 55 gal. at 90 psi.

Day #2 Cincinnati Sigma Blade MIXER 20 gal.

W & P lab Sigma Blade MIXER 1 gal.

IRVING BARCAN CO.

249-51 Orient Ave. Jersey City 5, N. J.
DElaware 2-6695-6

EVAPORATOR

One Swenson, Four Body, Compound Triple Effect, Long Tube Vertical, Film Type Evaporator. First three bodies operate triple effect while the fourth operates as a concentrator at double effect vacuum. Excellent condition. Complete inspection welcomed.

FS-6584, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

Modern
Rebuilt
Machinery

UNION

Rebuilt Machinery
Established 1912

Reduced for Quick Sale

2—Pneumatic Scale Co. Cartoning Units, consisting of Automatic Carton Feeders, Bottom Sealers and Top Sealers. 50 per minute.

1—Mikro Pulverizer with 40 HP motor and complete auxiliary equipment.

Stokes, Day, New Era, Hottman Mixers, from 2 to 450 gal., with and without jackets, single, double arm agitators, Baker Perkins, Day, Readco Heavy Duty, 1 qt. to 160 gals., Double Arm Jacketed Mixers, with Sigma or Fishtail Blades.

4—Fitzpatrick Stainless Steel Comminuters with 7½ HP motors and with Vibrator Feeders.

4—Scandia Practically New Automatic Cellophane Wrapping Machines, Model SFS-6F, with electric eyes.

1—Hayssen Model 10-20 Wrapping Machine, with electric eye.

Pony M, ML, World, Ermold, Pneumatic Semi and Automatic Labelers.

Day, Robinson, Tyler Hum-mer, Great Western, Gayco, Raymond Sifters.

Write, Wire, Phone For Details & Prices

TOP PRICES PAID FOR
YOUR SURPLUS EQUIPMENT

UNION STANDARD EQUIPMENT CO.

318-322 Lafayette St., New York 12, N. Y.

Phone: Canal 6-5333

NEW and
REBUILT

FANS BLOWERS EXHAUSTERS

Save 30% to 50%
on Stock
Shipments



We can supply all leading makes of ROTARY POSITIVE BLOWERS . . . TURBO BLOWERS . . . CENTRIFUGAL FANS . . . STEEL PLATE EXHAUSTERS . . . Fully Guaranteed! Whether you need 1 cu. ft. of air or 100,000 —we have the blower to do the job . . . plus 28 years' experience in rebuilding this type of equipment.

WRITE
OR WIRE

Send us your requirements, or write for complete listings.



WM. W. MEYER & SONS

8243 Elmwood Avenue
SKOKIE, ILLINOIS
Chicago Phone: INdependence 3-5127

FOR SALE

500 gal Glasco Glass Lined Jacketed agitated Reactor
 2' x 54' Column 30 Trays 268 Psi
 5' x 42' Column 18 Trays
 40" SS Bird Suspended Centrifuge perforated basket 30 1/2 HP
 30" Fletcher S.S. Suspended Centrifuge, perforated basket 10 1/2 HP XP
 18" x 28" Bird Cont. Centrifuge SS 304 Conical bowl V belt to 10 HP motor
 C27 Sharples Super-D-Hydrator
 Sweetland Filter #10 with 27 Steel bottom drainage leaves
 5'3" x 6' Oliver Precoat Filter, Rubber covered, Complete.
 30" Shriver Filter Press 20 chamber 4 eye washing
 15" x 15" Republic S.S. Filter Press 20 chamber Flexmaster
 275 Sq. Ft. Condenser S.S. tubes
 303 Sq. Ft. Alco Heat Exchanger, Admiralty tubes 350 Psi
 1020 Sq. Ft. Heat Exchanger 150 Psi
 24" x 20' Swenson Crystallizers (3)
 8'6" x 50' x 3/4" Rotary Kiln
 6' x 50' x 7/16" Rotary Dryer
 4' x 30' Rotary Coolers (2)
 502-16 Roto-Louvre Dryer with oil burner, blowers, and controls
 705-24 Roto-Louvre Dryer with aerofin coils, blowers, and controls
 6' x 10' Rotary Vac Dryer chrome plated
 5' x 30' Builovak Rotary Vac Dryer
 Mitts & Merrill 30" x 36" Model 15CF Hogs
 2100 gal. S.S. agitated tank
 8' x 8' Rubber lined Steel Tanks

HEAT & POWER Co., Inc.**PROCESS EQUIPMENT DIVISION**

60 EAST 42nd ST.
 NEW YORK 17, N.Y.
 Murray Hill 7-5280

310 THOMPSON BLDG.
 TULSA 3, OKLAHOMA
 Diamond 3-4890

FOR SALE**BRAND NEW AIR EJECTORS**

(Twin Stage Tubejet Air Pumps)

Applicable for Surface Condensers from 400 to 8000 Square Feet.

Priced at a fraction of their present cost.

Full details and Performance Data available.

J. A. DOUGHERTY
 P. O. Box 90 - Bala-Cynwyd, Pa.

"SEARCHLIGHT"

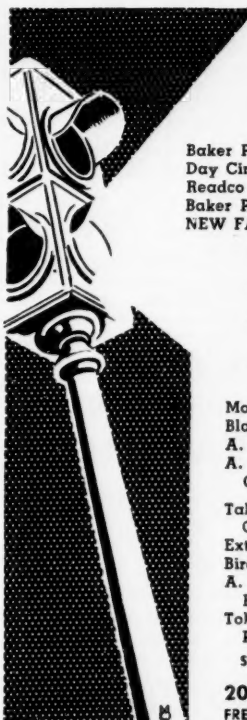
IS

Opportunity Advertising

—to help you get what you want—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"THINK SEARCHLIGHT FIRST"**NO WAITING!****THIS GUARANTEED EQUIPMENT CAN BE OPERATING IN YOUR PLANT NEXT WEEK**

Baker Perkins Mass Mixers; Dbl. Arm; Jktd. to 300 gal.
 Day Cincinnati Stainless 300 Gal. Jktd. Mixer
 Readco Stainless Vacuum Mixer; 24"x48"; Jktd. Complete
 Baker Perkins Stainless Dispersion Mixer, 100 Gal. 75 HP.
 NEW FALCON Stainless Ribbon Mixers; 10, 17 1/2, 40 & 86 cu.ft.

Buhrstone and Porcelain Lined Pebble Mills; 6'x5'; 6'x6'; 6'x8'; 8'x8'

Hardinge Conical Ball or Pebble Mill 10"x36"; silica block lining

Mikro Pulverizers from Bantam size to No. 4; Fitzmill Model K7

Heavy Duty Hammer Mills by Raymond, Williams, Gruendler etc.

Mojonier Stainless Vacuum Pans; 3'x10' and 6'x12'

Blaw Knox Stainless Resin Autoclave; 7'6"x7'6"

A. O. Smith Stainless Autoclaves; 1200 Gal.; 1500 Gal.

A. O. Smith Stainless Lined Pressure Tanks; 10'x30'; 20,000 Gal.

Tablet Presses; Stokes RB2, BB2, RD3, DDS2; Kux 60A; Colton 4 1/2 T

Extruders; Royle No. 3; NRM 2 1/2"; Bonnett-Terrier 4"

Bird Continuous Conical Bowl Centrifugals; 18"x28"

A. T. & M. 26" Stainless Underdriven Centrifuge; Perf. Basket

Tolhurst 40" Rubber Covered Susp. Centrifugals; Monel Plows

SEND FOR COMPLETE LIST of Ready to Ship Equipment in Stock

209-289 10th St.

Bklyn. 15, N. Y.

FRED R. FIRSTENBERG, Pres.

ST. 8-4672

FIRST MACHINERY CORP.**LOEB OFFERINGS**

Autoclave: 50 gal. Struthers-Wells, st. st.
 Boilers: Gas fired 60, 15, 2, 1 hp.
 Centrifugals: Fletcher 12" copper.
 Centrifuge: Inter. size 3 mod. FS. 2 hp.
 Clarifiers: De Laval 34-51, SVKSR. 04-21.
 Condensers: stainless steel and copper.
 Crystallizers: 500 gal. stainless steel, jack.
 Dryers: Devine 2 x 4' vac. drums, st. steel.
 Evaporator: Builovak double effect st. st.
 Fillers: for liquid, paste, powder.
 Filters: Oliver 2 1/2 x 1', Sparkler, Alsop, Lomax, Industrial.
 Filter Presses: Sperry, Shriver 6" to 36".
 Kettles: Stainless steel 20 to 500 gal. with and without agitators.
 Mills: Pebble, Abbe #5, 36 gal.
 Ball: 4 x 5' chrome manganese.
 Mikro: Bantam, #1SH, #2TH, 24".
 Hammer: Jeffrey 30 x 24" type A.
 Colloid: Charlotte iron, 25 hp.
 Mixers: Dbl. and sq. arm sigma blade.
 Jacketed horiz. 550 gal. st. steel.
 Percolators: Pfaudler 54 x 42" st. st. jack.
 Send us your inquiries and list of idle equipment

LOEB EQUIPMENT SUPPLY CO.

818 W. Superior St. Phone: Seeley 8-1431
 Chicago 22, Ill. Our 33rd Year

COMPRESSORS

1902-1957

World's Best Rebuilds

110 CFM	3000 PSI Ingersoll 4 Stage
138 CFM	100 PSI 7x7 Ing. ES1
368 CFM	100 PSI 12x10 Ing.-Penn
503 CFM	220 PSI 13 1/2/7x13 Ing. ES-2
528 CFM	100 PSI 14x12 Ing. ERI
585 CFM	100 PSI 15-9 1/2x12 Ing. XRE
590 CFM	100 PSI 13 1/2-8x8 Penn DE2
676 CFM	100 PSI 15-9 1/2x12 Worth
688 CFM	100 PSI 14x13 Worth HB
688 CFM	100 PSI 17-10x12 Chic. OCE
870 CFM	125 PSI 17-10 1/2x12 Ing. XRE
1007 CFM	100 PSI 19-11x12 Chic. OCB
1270 CFM	40 PSI 19x13 Ing. ES1
1292 CFM	Vacuum 22x9 Ing. ES
1300 CFM	210 PSI Ingersoll 3 Stage Steam
1712 CFM	20 PSI 23x13 Ing. ES-1
2832 CFM	Vacuum 31x13 Ing. ES-1
7950 CFM	200 PSI 33-17 1/2x27 Ing. PRE 360-2300

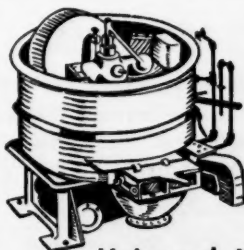
Portables 60-600 CFM Rotary or reciprocating.

American

AIR COMPRESSOR CORP.

NORTH BERGEN, N. J.

Telephone UNion 3-4444

**#0 SIMPSON INTENSIVE MIXERS NEVER USED**

Style: M... Diameter: 3' Capacity: 1 1/4 cu. ft.

Unit Drive—Air Operated Door

ACQUISITION COST: \$2935. each

OUR PRICE: \$1495.

each complete with 5 Hp motor & drive.

Universal Machinery & Equipment Company

1630 NORTH NINTH ST., READING, PA. — PHONE FRanklin 3-5103 COLLECT

IMMEDIATE DELIVERY**Patterson Kelley
TWIN SHELL DRY BLENDER**

- 3 cu. ft. Capacity
- Like new

**2—International
BALL MILLS**

- 6' Dia.x8' and 6' Dia.x10'
- Porcelain Lined
- 25 H.P. Gearhead Motors
- Excellent Condition

PRICED RIGHT — CALL COLLECT

Universal Machinery & Equipment Co.1630 N. NINTH ST., READING, PA.
Phone: FRanklin 3-5103**ROTARY KILNS FOR SALE**

- 2—8'0" x 150'0" Vulcan, 3/4" and 2" Plate, All Welded
- 1—7'6" & 9'0" x 200'0" 3/4" and Heavier Welded and Riveted
- 1—7'6" & 11'0" x 200'0" Vulcan 3/4" and 2" Plate, All Welded

STANHOPE, 60 E. 42, N. Y. 17, N. Y.**FOR SALE**

- 1—Burlakov F-20 Vacuum Shelf Dryer.
- 6—Stainless steel Tanks 300-1200 gals.
- 1—Fletcher 40" Centrifugal, S.S. basket.
- 2—Lightnin 7 1/2 H.P. Turbo Agitators, 100 r.p.m.
- 1—Fletcher 30" suspended type Centrifugal, stainless steel contact parts.
- 1—Superior 500 H.P. "Package" Boiler, 160# W.P.
- 2—Oliver 8 x 12" Vacuum Drum Filters.
- 2—Sharples C-20 & C-27 Super-D-Hydrators.
- 1—12,000 gal. rubber lined Acid Tank.

The Machinery & Equipment Corp.293 Frelinghuysen Ave. Newark 12, N. J.
TAIbot 4-2050**CONDENSERS FOR SALE**

- 3—BRAND NEW "WHEELER" 2-pass, 725 Sq. Ft. Surface Condensers—equipped with Copper Nickel Tubes and Tube Sheets—Bronze Water Boxes.

Print and Operating Data available.

Price:—\$3,250.00 each

J. A. DOUGHERTY

P. O. Box 90 Balto-Cynwyd, Pa.

**When You Think of Plastics
Rubber & Chemical Machinery
Think of**

JOHNSON MACHINERY CO.

Largest Stock in the U. S.

Extruders, Tablet Presses, Injection Molders,
Hydraulic Presses, Scrap Cutters, Calenders, Mills,
Blenders, Mixers, Ovens, Hydraulic Pumps, Laminating & Molding Equipment.

See Us First:

JOHNSON MACHINERY CO.679 Frelinghuysen Ave., Dept. CE
Newark, N. J. Biglow 8-2500**JANUARY SPECIALS**

Stokes Vac. Shelf Dryer 18 shelves 40" x 44"
Desimo Vac. Shelf Dryer 6 shelves 40" x 43"
Pfaudler Glass Kettles S.S. agitator 3 HP exp. mtr.
Gen. American 42" x 120" twin Drum Dryer
3—20,000 gal. steel tanks, welded, dished heads
Pfaudler SS Reactor, 125 gal., jktd. & agtd.
Nash Hytor Vac. Pump #6, with 40 H.P. motor
Tolhurst 40" Cent. Plough & bottom dump.
Sweetland #3 SS Filter, 20" leaves, on 3" cent.

WE BUY COMPLETE PLANTS OR SINGLE
UNITS. WHAT HAVE YOU FOR SALE OR
TRADE? YOU CAN BANK ON**EQUIPMENT CLEARING HOUSE, INC.**111 33rd Street, Brooklyn 32, N. Y.
SOuth 8-4451—4452—8782**FOR SALE
AT TALLANT, OKLA.
CHEMICAL PLANT**

- 1—10' x 20' Aluminum Bronze
Horizontal Tank, 3/16" Shell,
1/4" Head. Purchased New 1954.
Price \$4500.00.

CITIES SERVICE OIL—PATRIDGE
BARTLESVILLE, OKLAHOMA**SURPLUS EQUIPMENT
FOR SALE**

125 gal. full-jacketed, open kettle, hinged
cover, heavy-duty double motion agitator.
Three inch bottom flush valve. All
internal parts 316 Type stainless steel.
U.S. Varidrive unit with 7 1/2 h.p., 220/440,
60 cycle, explosion-proof motor.

Ideal unit for mixing heavy creams, etc.
Used for a short time on pilot plant work.**The Warren Development Corp.**

P. O. Box 229, Hackettstown, N. J.

PIPE 1/8" thru 30"**TESTED & STRUCTURAL
Large Warehouse Stocks**

- SPIRAL WELD • SEAMLESS
- ELECTRIC WELD • LAP WELD
- BUTT WELD • CONTINUOUS

RAILS - TRACK EQUIPMENT - PIPE - PILING

L.B. FOSTER co.PITTSBURGH 30 • NEW YORK 7 • CHICAGO 4
ATLANTA 8 • HOUSTON 2 • LOS ANGELES 5**New Advertisements**

received by January 6th will
appear in the January 27th is-
sue subject to limitations of
space available.

Classified Advertising Division

CHEMICAL ENGINEERING

Box 12

New York 36, N. Y.

**SEARCHLIGHT
Equipment
Spotting
Service**

This service is aimed at helping you,
the reader of "SEARCHLIGHT", to
locate Surplus new and used equip-
ment not currently advertised. (This
service is for USER-BUYERS only.) No
charge or obligation.

How to use: Check the dealer ads
to see if what you want is not cur-
rently advertised. If not, send us
the specifications of the equipment
wanted on the coupon below, or on
your own company letterhead to:

**Searchlight Equipment
Spotting Service**

Classified Advertising Division

Chemical Engineering

P.O. Box 12, N.Y. 36, N.Y.

Your requirements will be brought
promptly to the attention of the
equipment dealers advertising in
this section. You will receive re-
plies directly from them.

Searchlight Equipment
Spotting Service
Classified Advertising Division
CHEMICAL ENGINEERING
P. O. Box 12, N. Y. 36, N. Y.

Please help us locate the following:

.....
.....
.....
.....
.....
NAME.....
TITLE.....
COMPANY.....
STREET.....
CITY.....ZONE.....
STATE.....C-86

GET in the SWIM!

SEE **GELB** for EXTRA VALUES in CHEMICAL PROCESS EQUIPMENT

- 1—Stokes Stainless Steel Jacketed Rotary Vacuum Dryer, 3' x 15', Model 59B.
- 1—Stokes Steel Jacketed Rotary Vacuum Dryer, 5' x 30', Model 59DS.
- 1—Stainless Steel Counter-current Rotary Dryer, 3' x 20', complete.
- 1—Louisville Rotary Steam Tube Dryer, 8' x 45'.

CENTRIFUGES:

- 1—Tolhurst 32" Suspended Type Centrifuge with Stainless Steel Perforate Basket, Plow and Curb, 25/12½ HP motor.
- 1—Tolhurst 32" Suspended Type Centrifuge with Imperforate Basket.
- 2—Sharples Type 316 Stainless Steel Centrifuges, Model D-2 (New).

AUTOCLAVES, KETTLES AND TANKS:

- 2—Glasco 150 gallons Glass lined Jacketed Stills, complete with Condenser and Receiver.
- 2—Pfaudler Glass-lined Series R Jacketed Reactor, 1000 gallons each.
- 2—Vertical Aluminum Storage Tanks, 12,500 gallons each.
- 4—Vertical Aluminum 1720 gallons pressure Tanks.
- 1—Pfaudler 1500 gal. Monel Jacketed Reactor, with agitator, drive and motor, 50 # Jacket.
- 3—Stainless Steel Jacketed 2000 gallon Kettles
- 1—Stainless Steel Jacketed 400 gallon Kettle with Turbo Agitator and drive.
- 1—Pfaudler Series XL Glass lined Jacketed Kettle, 1000 gal. capacity.
- 1—Pfaudler Glass-lined Jacketed Kettle, Series ELL, 750 gal. cap.
- 1—Nickle Jacketed 1000 gal. Kettle.
- 1—Combustion Engineers Steel Jacketed Autoclave, 1600 gallons, with agitator and drive, 150 # Jacket 600 # internal.
- 1—Autoclave Engineers Type 316 Stainless Steel Autoclave, 5000 # pressure, 1 gallon capacity.

DRYERS:

- 2—Link Belt Steel Roto-Louvre Dryers, 207-10 and 310-16.
- 1—Stainless Steel Rotary Dryer, 3' x 12', complete.
- 2—Louisville Rotary Dryers, 6' x 45', complete.
- 2—Columbia Engineers Rotary Dryers, 6' 4½" x 45', complete.
- 2—Louisville Rotary Steam Tube Dryers, 6' x 50'.
- 1—Bartlett & Snow Rotary Dryer, 4' 6" x 36' 6".
- 1—Stokes Double Drum Dryer, 5' x 12'.



THE GELB GIRL—JANUARY, 1958

MIXERS:

- 1—Readco Steel Jacketed 25 gal. Double Arm Sigma Blade Vacuum Mixer.
- 1—Baker Perkins Stainless Steel Double Arm Sigma Blade Jacketed Mixer, 30 gallons.
- 1—Baker Perkins #16 TRM 150 gallon Jacketed Double Arm Sigma Blade Vacuum Mixer, 60 HP motor.
- 2—Baker Perkins Double Arm Sigma Blade Jacketed Mixers, 100 gallons
- 3—Robinson Type 316 Stainless Steel Sigma Type Jacketed Heavy Duty Mixers, 400 gallons capacity, 60 HP.
- 1—Leader Stainless Steel Jacketed Horizontal Ribbon Blender, 40 cu. ft.
- 1—Process Engineers Stainless Steel Jacketed Ribbon Blender, 30 cu. ft.

MISCELLANEOUS:

- 2—Williams Type 316 Stainless Steel Hammer Mills, Model AK, Size 8½" x 30½".
- 1—Richmond Engineers, Type 316 Stainless Steel Condenser, 350 sq. ft.
- 3—Davis Engineering Type 347 Stainless Steel Heat Exchangers, 200 sq. ft. each (New).
- 4—Type 317 Stainless Steel Heat Exchangers, 892 sq. ft. each, 200 PSI, ASME Code.
- 4—Karbate 60 sq. ft. Heat Exchangers.
- 2—Combustion Engineers Water Tube Package Boilers, 200 HP, 275 # pressure.
- 1—Komarek Greaves Briquetting Machine with 50 HP motor.
- 1—Ingersoll Rand Air Compressor with 300 HP motor, 1600 CMF, 100 # pressure.
- 1—Williams 4-roll Mill, complete.
- 1—Raymond 3 roll High Side Mill, complete.

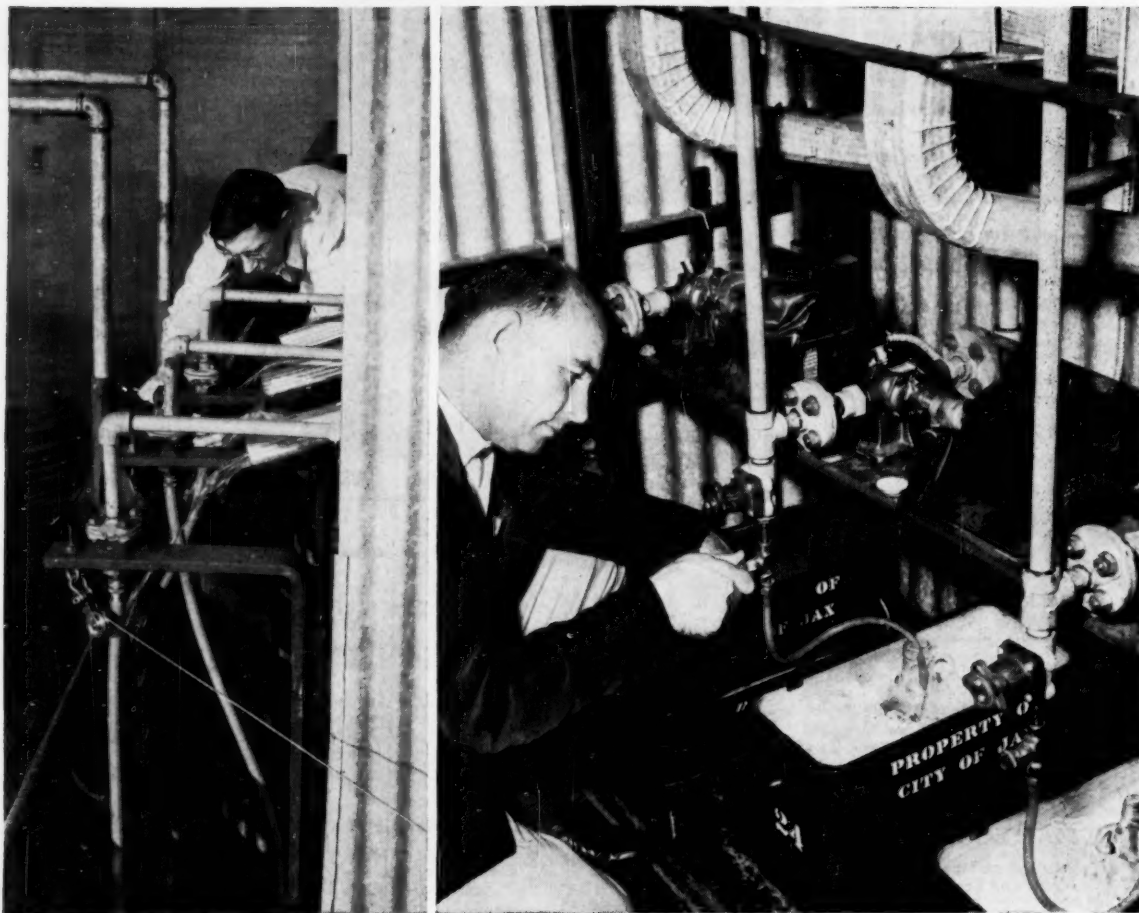
- 1—Oliver Horizontal 3' Pilot Plant Filter (New).
- 1—Feinc Stainless Steel Rotary String Filter, 3' x 3' (New).
- 1—AT&M 42" Stainless Steel Suspended Type Centrifuge, with perforate basket, complete with motor and plow.
- 1—Pfaudler Stainless Steel Type 316 Jacketed Reactor, with agitator drive and motor, 1500 gallons.

Established 1886
R. GELB & SONS, Inc.,

CHEMICAL, RUBBER, OIL, PLASTIC and FOOD PROCESSING MACHINERY
U.S. HIGHWAY No. 22, UNION, N.J.

• MURDOCK 6-4900

B.F. Goodrich



Koroseal helps analyze water in St. Johns River

IN a small building atop the Main Street bridge in Jacksonville, Florida are three motor-driven paddle pumps. Their job is to suck up water from the St. Johns River at three different depths—3, 38 and 72 feet—for use in continuing year-after-year laboratory analyses.

But chlorine content of the water runs high—reaching a maximum of 12,000 PPM at times—and so the pipes had to have unusual resistance to chlorides. That's why the City of Jacksonville chose B.F. Goodrich rigid Koroseal PVC pipe, valves and fittings. City engineers report continuous trouble-free operation.

Unusual application? Yes, but Koroseal rigid polyvinyl chloride pipe now

provides excellent service in countless unusual applications where standard metal piping is inadequate. It's unaffected by most alkalies and acids, and is completely inert in the presence of oil, alcohol, and salt solutions. Unusually strong, it has high impact resistance and is available in tubes, rods, valves and sheets.

Other reasons for the growing popularity of Koroseal PVC are low initial cost . . . ease of installation . . . light weight . . . economical maintenance. It can be threaded, cut, welded or drilled—and never needs painting.

To get more information on how Koroseal can make your operation more efficient and profitable, fill in and mail the coupon to your right.



B.F. Goodrich Industrial Products Co.
Dept. CE-1
Marietta, Ohio

Please send me free booklets on:

- ☐ Rigid Koroseal Pipe
☐ Rigid Koroseal Sheet

Name

Company

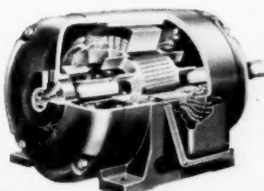
Address

City Zone State

Koroseal—T. M. Reg. U. S. Pat. Off.



GIVE YOUR PRODUCTS THE BEST OF BRAKES!

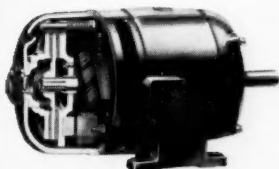


Type D, AC Dynamic

ROLLING STOP... Master Type D Dynamic Unibrake Motors. Braking is obtained with a unique, patented brake winding superimposed on the stator winding. Simple, compact, with no DC current required, the brake has no moving parts. There is nothing to wear or adjust... braking torque repeats consistently. Particularly recommended for automatic applications where static holding is not desired. Sizes $\frac{1}{4}$ to 30 H.P.



UNIBRAKE MOTORS



Type M—Magnetic

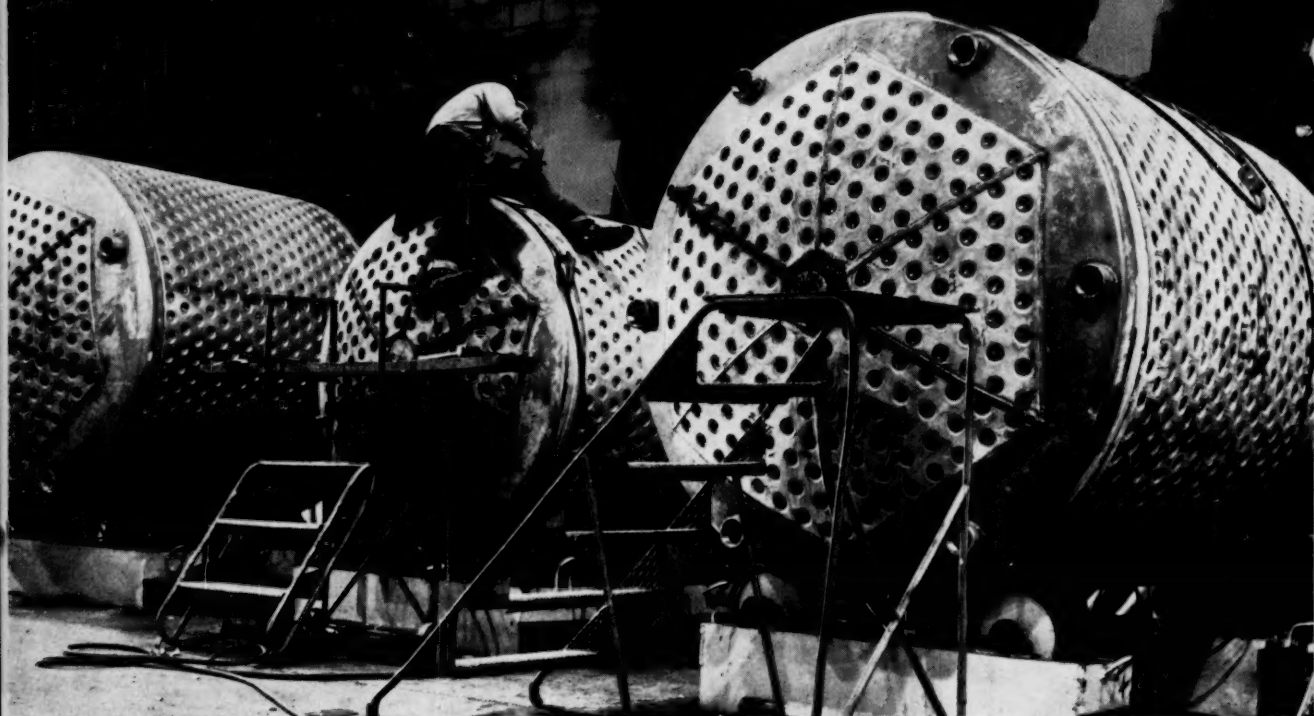
STOP - HOLD... Master Type M Magnetic Unibrake Motors. For quick, controlled stopping... especially when you want to hold the load. Spring-setting magnetic brakes of the friction disc type combine with motor in a compact, integral unit. Sizes... $\frac{1}{8}$ to 150 H.P.

MASTER GEARMOTORS and variable speed drives can be furnished with Unibrakes, too. See Master for the perfect power drive for you.

THE MASTER ELECTRIC CO.

DAYTON 1, OHIO

DIVISION OF RELIANCE ELECTRIC AND
ENGINEERING CO.



These dimpled jacketed reactors are code-accepted for pressures far beyond conventional jackets of equivalent wall thickness.

You get more for your stainless steel dollar in these *dimpled* jacketed vessels

Substantial cost savings can be yours when you take advantage of Pfaudler's exclusive code-approved dimpled jacket on stainless steel processing vessels.

This design permits jacket pressures up to 150 psi *without increasing metal thickness!* And it is only one of many ideas Pfaudler has evolved to give you more for your stainless steel dollar.

To start with, you have a choice of *standard designs* from which you can select jacketed reactors or kettles

from 5 to 2000 gallons. They are built of Types 304 and 316 stainless steel which are carried in stock along with such prefabricated parts as nozzle openings, agitators, stuffing boxes and drives.

Generally, units from 5 to 500 gallons have conventional jackets and clamped-top heads. There are ample openings to accommodate most processes.

By taking advantage of all of these features, you not only save money but get your equipment faster. You auto-

matically eliminate the time consumed in preparing engineering drawings and estimating prices. All you need really is our Bulletin No. 944 which spells out sizes and detailed specs.

Heat treating can mean big savings, too

Frequently, you can use a cheaper grade of stainless steel by having it heat treated after fabrication. Pfaudler facilities will handle a vessel of almost any size.

THE PFAUDLER CO.

a division of PFAUDLER PERMUTIT INC. • Rochester 3, New York

